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FOR THE YEAR

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Director General of Observatories

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GOVERNMENT OF INDIA.

METEOROLOGICAL DEPARTMENT.

MONTHLY WEATHER REVIEW

PUBLISHED BY ORDER OF

THE GOVERNMENT OF INDIA.

CALCUTTA, JANUARY, 1917.

INTRODUCTION.

THIS review of the weather in India during the month of January, 1917, is based on observations taken daily at 8 hrs. at 217 stations, and on additional observations taken at 10 hrs. and 16 hrs. at 12 stations. In the rainfall summary have been utilised the data furnished by the meteorological observatories, and the rainfall statements of the month published by the Provincial Governments.

The brief notes on solar, magnetic and seismic disturbances are supplied by the chief observatories in the Indian area.

In the remaining monthly reviews of the present year the brief statements of the methods of recording and tabulating the data, for each of the elements of observation, given in the present number at the commencement of each section, will not be repeated.

New normals of pressure, temperature, humidity and cloud derived from the records of the years prior to 1911 have been used from January 1915 in Tables B and C of the review.

Summary of the chief features of the weather in India during the month.

2. Several disturbances entered northern India but did not produce much precipitation, with the result that the total rainfall over the plains fell short of the normal by 0·3″ or 65 per cent. The defect was common to all the divisions; and it equalled or exceeded half an inch in Bihar and Orissa, the United Provinces, the Punjab and the North-West Frontier Province. In Baluchistan the recorded fall was almost equal to the average, while in Kashmir it was in defect by 2″ or 55 per cent.

Of the other climatic elements humidity was markedly above normal in Sind and cloud amount was in decided excess generally in Burma and the south of the Peninsula. Mean temperature exceeded the normal by 2° in Sind and Rajputana, but in the remaining divisions average conditions prevailed.

Barometric pressure averaged over the plains of India was higher than usual by ·026″.

Solar, magnetic and seismic disturbances.

KODAIKANAL OBSERVATORY.

3. *Solar observations.*—Observations are very rarely deficient in January but this year no observations were possible on five days in the month, and on two other days no prominences were recorded. On four days the prominence record was imperfect.

Sunspots.—The rise in spot activity noticed in the previous month was maintained in January. There were 32 new groups with a daily average of 6·0 and the average life of a spot was 4·8 days.

The distribution of spots in latitude was as follows :—

TABLE 1.

—	0°–10°	11°–20°	21°–30°	Mean latitude.	Extreme latitudes.
North . . .	3	10	4	15°·9	11° & 27°
South . . .	...	10	5	19°·2	11° & 28°

Spot group No. 2586, first seen in December, contained a large spot which broke in two on January 4th, and on the 6th the C line showed strong reversal and displacement towards violet of 2 A.

Prominences.—Eighty-five large, one eruptive, and four metallic prominences were recorded. The highest was an eruptive prominence 270″ high photographed near the east limb on the 25th. Prominences 200″ high were recorded on the 22nd and 26th.

Magnetic disturbances.—A "great" disturbance was recorded on the 4th and 5th. "Moderate" disturbances were recorded from the 6th to the 10th and from the 21st to 26th. The earlier series, especially the "great" one, were very probably connected with the active spot group No. 2586 mentioned above.

J. EVERSHED,
Director,
Kodaikanal and Madras Observatories.

Seismic records.

$\phi = 10° 13' 50''$; $\lambda = 77° 28' 00''$; $h = 2343$ m. *Subsoil* Rock.

Apparatus.—Milne's Horizontal Pendulum Seismograph.

TABLE 2.

	V	To	ϵ	$\frac{r}{To^2}$
AN:				
AE:	9·76	17·4	1	2·6
AZ:				

Date.	Phase.	Time G. M. T.	Period (Sec.)	Amplitude (u) AN.	AE.	AZ.	Distance Δ (Km.)	Remarks.
1917.		h. m. s.						
Jan. 4th	e P	17 11 42	...	...	...	...	...	No records January 6th to 8th.
	e L	17 18 00	...	...	...	...	...	
	M	17 22 06	...	...	80	...	...	
	F	17 44 00	...	...	...	...	...	
„ 17th	e P	2 55 24	...	...	...	...	...	Widening of line.
	F	3 24 54	...	...	...	...	...	
„ 20th	i P	23 25 48	...	...	...	...	...	
	i L	23 32 18	...	...	...	...	...	
	M	23 38 36	...	...	250	...	...	
„ 21st	F	0 41 42	...	...	...	...	...	
1917.		h. m. s.						
Jan. 24th	e P	1 10 18	...	...	...	...	...	Widening of line.
	F	2 01 00	...	...	...	...	...	
„ 26th	e P	5 55 24	...	...	...	...	...	Widening of line.
	F	6 12 42	...	...	...	...	...	
„ 30th	e P	2 57 48	...	...	...	...	...	
	e L	3 07 24	...	...	...	...	...	
	M	3 42 12	...	...	1,350	...	...	
	F	7 13 42	...	...	...	...	...	
„ 30th	e P	8 08 36	...	...	...	...	...	Widening of line.
	F	8 25 54	...	...	...	...	...	
„ 31st	e P	4 08 00	...	...	...	...	...	
	i L	4 23 00	...	...	...	...	...	
	M	4 33 54	...	...	190	...	...	
	F	5 37 06	...	...	...	...	...	

T. ROYDS,
Assistant Director.

BOMBAY OBSERVATORY.

Alibag Magnetic Record.

4. During the month of January, 1917, the traces showed 9 calm days, 21 days of small and 1 day of great disturbance.

The days of the month selected as "quiet" for the purposes of the Magnetic Survey of India are the 3rd, 14th, 15th, 18th and 28th.

The following table represents the magnetic character of each day during the month:—

TABLE 3.

Day.	Character.	Day.	Character.	Day.	Character.	Day.	Character.
1	S	9	S	17	C	25	S
2	C	10	S	18	C	26	S
3	C	11	S	19	S	27	S
4	G	12	S	20	S	28	C
5	S	13	S	21	S	29	C
6	S	14	C	22	S	30	S
7	S	15	C	23	S	31	S
8	S	16	C	24	S		

C.=calm; S.=small; M.=moderate; G.=great; V. G.=very great.

The mean observed absolute values of the several magnetic elements reduced to the mean monthly tabulations of the magnetograms, as also the ranges and the summed ranges of the horizontal force and the declination for the month are as follows :—

Easterly declination	0° 34′ 37.″
Horizontal force	0·36853 C.G.S. unit.
Vertical force	0·16844 C.G.S. „
Inclination	24° 33′ 8″.
Horizontal force range	0·00039 C.G.S. unit.
Horizontal force summed range	0·00227 C.G.S. „
Declination range	2′·4.
Declination summed range	9′·8.

(NOTE.—Summed range means sum without regard to sign of the 24 ordinates of the diurnal inequality.)

Seismic records.

$\phi = 18° 53′ 36″$ $\lambda = 72° 48′ 56″$; $h = 11$m. *Subsoil* Trap.

Apparatus.—Milne's Horizontal Pendulum Seismograph.

TABLE 4.

	V	To	ϵ	$\frac{r}{To^2}$
AN:				
AE:	9	21	1	
AZ:				

Date.	Phase.	Time G. M. T.	Period (Sec.)	Amplitude (a) An.	Ae.	Az.	Distance Δ (Km.)	Remarks.
1917.		h. m. s.						
Jan. 4th	P	17 4 56	...	...	...	...	...	
	M	17 21 30	...	...	44	...	...	
	F	17 34 30	...	...	...	...	...	
„ 17th	...	10 41 0	...	...	...	...	...	Thickening of line.
„ 20th	P	Mixed in tremors.	...	...	...	...	...	P as shown by Tromograph is at 20d. 23h. 20m. 35s.
	S	23 27 20	...	...	...	...	...	
	M	23 44 54	...	...	111	...	...	
	F	...	...	...	...	...	...	End mixed in the beginning of another disturbance which is masked by tremors.
1917.		h. m. s.						
Jan. 26th	P	...	...	...	...	...	...	Beginning uncertain.
	M	5 56 49	...	...	22	...	...	
	F	6 12 13	...	...	...	...	...	
„ 30th	P	Mixed in tremors.	...	...	...	...	...	P as shown by Tromograph is at 30d. 2h. 57m. 24s.
	S	3 6 50	...	...	...	...	...	
	M	Traces overlap	...	...	...	...	...	
	F	6 52 0	...	...	...	...	...	
„ 30th	...	8 6m to 8m	...	...	...	...	...	Thickening of line.
„ 31st	P	4 9 10	...	...	...	...	...	
	M	4 35 59	...	...	167	...	...	
	F	5 7 19	...	...	...	...	...	

Sensibility to tilt 1·0 mm. of amplitude on the trace = 0″·32.

One disturbance beginning in Tromograph at 20 d. 23 h. 54 m. 9s. and another at 24d. 0h. 56m. 14s. are masked by tremors.

N. A. F. MOOS,
Director,
Bombay and Alibag Observatories.

5.—CALCUTTA (ALIPORE) OBSERVATORY.

Seismic records.

$\phi = 22° 32′$ N; $\lambda = 88° 20′$ E; $h = 21$. *Subsoil* Alluvial.

Apparatus.—Two Omori Ewing Horizontal Pendulum Seismographs.

TABLE 5.

	V	To	ϵ	$\frac{r}{To^2}$
AN:	29	20	1	
AE:	29	45	1	
AZ:				

Date.	Phase.	Time G. M. T.	Period (Sec.)	Amplitude (a) An.	Amplitude (a) Ae.	Amplitude (a) Az.	Distance Δ (Km.)	Remarks.
1917.		h. m. s.						
Jan. 4th	P	16 56 18	5	...	...	...	...	
	S	17 3 18	8·5	...	...	...	...	
	L	17 9 6	12	...	...	...	...	
	M	17 10 18	12	190	138	...	...	
	F	17 45 18	...	...	...	...	...	
„ 20th	P	23 19 18	6	...	...	...	...	
	S	23 28 54	9	...	...	...	...	
	L	23 38 24	17	...	...	...	...	
	M	23 44 30	17	1207	...	...	...	
„ 21st	F	0 45 42	...	...	...	...	...	
„ 24th	P	0 55 00	4·5	...	...	...	...	
	S	1 0 36	6	...	...	...	...	
	L	1 4 48	16	...	...	...	...	
	M	1 5 48	16	379	...	...	...	
	F	1 36 48	...	...	...	...	...	
„ 30th	P	2 56 12	6	...	...	...	...	Other measurements were impossible, as the instrument was affected by the shock.
	S	3 4 42	15?	...	...	...	...	
	L	3 12 24	18	...	...	...	...	
„ 31st	P	4 7 48	5	...	...	...	...	
	S	4 17 18	12	...	...	...	...	
	L	4 27 18	19	...	...	...	...	
	M	4 28 54	19	259	...	...	...	
	F	5 1 24	...	...	...	...	...	

6.—SIMLA OBSERVATORY.

The following table contains a list of earthquakes that were reported :—

TABLE 6.

Place at which felt.	Date.	G. M. T. of earthquakes.	Duration.	Intensity Rossi-Forel scale.	No. of shocks.	Remarks.
		h. m.	Sec.			
Drosh . . .	Jan. 8th	7 40	6	7	2	
Mandalay . . .	„ 21st	10 40	3	5	3	
Salonah (District Nowgong, Assam).	„ 26th	0 56	8	5	1	
Drosh . . .	„ 26th	15 50	7	6	2	

Solar radiation.—Observations not recorded owing to absence of officers on war service.

The Simla Seismograph notes will appear in a future number of this Review.

GILBERT T. WALKER,
Director-General of Observatories, Simla.

Weather in the Indian Ocean.

7. Barometric pressure differed little from the average. Winds were fairly normal as regards direction, but their velocity was higher than usual at Seychelles and below the average at Mauritius and Zanzibar. Rainfall was in excess at Mauritius, and deficient at the other two stations.

TABLE 7.

	Mauritius.	Zanzibar.	Seychelles.
Departure from normal of mean pressure	+ ·003	+ ·001	— ·010
Actual mean wind direction . .	N 75° E	N 27° E	N 25° W
Normal mean wind direction . .	S 87° E	N 28° E	N 39° W
Actual mean wind velocity (miles per diem).	113	106	145
Normal mean wind velocity (miles per diem).	169	137	107
Rainfall departure from normal . .	+ 1·84	— 1·17	— 4·16

Depressions and cyclonic storms.

8. Six disturbances appeared in Persia in rapid succession, but none of them were transmitted definitely into northern India. The first gave fairly general but light rain in Baluchistan at the beginning of the month; the second and the third were practically rainless; the fourth produced nearly general and light to moderate precipitation in Balu-

chistan from the 12th to the 14th, in Kashmir from the 13th to the 16th and in the Punjab on the 14th and 15th; and the fifth and the sixth were the cause of widespread rainfall in Baluchistan and Kashmir, the North-West Frontier Province and the submontane Punjab between the 19th and the 25th. In addition to these six western disturbances there was evidence on the morning of the 27th of the existence of a diffuse depression over Sind and the adjoining districts of Rajputana and Gujarat. This gave rise to numerous light falls of rain in the plains of the United Provinces and some snow in the Simla and Kumaon hills on the 27th and 28th.

In connection with the prevalence of unusually dry weather over northern India it is interesting to note that rainfallwas markedly in excess during the month in Ceylon.

Pressure.

9. In most of the observing stations in India mercurial barometers on Fortin's principle of fiducial point adjustment, with tubes of 0·4″ bore throughout, have always been in use. But of late years there has been an increasing number of barometers on the Kew principle, which has its scale divided to compensate for the change of level of the mercury in the cistern as the pressure alters.

The following list contains the names of all stations equipped with instruments of the latter class:—

Aden.	Gangtok.	Noakhali.
Akyab.	Gopalpur.	Nowgong.
Amini Divi.	Gorakhpur.	
Barisal.	Jalpaiguri.	Rangoon.
Bhamo.	Kyaukpyu.	Ratnagiri.
Bushire.	Mangalore.	Saugor C. P.
Cochin.	Midnapore.	Tavoy.
Cox's Bazar.	Minbu.	Toungoo.
Cuddapah.	Monywa.	Victoria Point.
Delhi.	Mymensingh.	Yamethin.
Dinajpur.	Negapatam.	Zanzibar.

The instruments at the following stations are by various makers and of various kinds:—

Colombo.	Katmandu.	Panjgur.
Dalbandin.	Kurnool.	Trincomalee.
Fort Sandeman.	Lyallpur.	Trivandrum.
Kalat.	Patiala.	

At Calcutta and Bombay the standards are Newman instruments on the Fortin principle, with adjustable scales and fiducial points, and tubes of large bore.

All instruments are compared at Calcutta before issue, and their corrections determined to the Calcutta standard, which was until 1910, 0·1″ higher than the Kew standard. The present difference is probably less than this, but the determination of the exact amount is a matter of considerable difficulty (see the Departmental Memoirs, Vol. XXI, pp. 127—8, 1916).

The barometers are in all cases situated in masonry buildings to protect them as much as possible from rapid changes of temperature.

Those heights above mean sea-level of the barometers of all stations given in Table B or Table A, which have been obtained accurately by actual measurement, are given in Roman figures. In the great majority of cases they have been referred to datum levels determined by the Great Trigonometrical Survey of India; of the remaining stations those heights which have been determined barometrically are printed in italics.

The readings of the barometers are reduced to 32°F., and from 1st January 1905, have been corrected to constant gravity in all cases. They are reduced to sea-level in the cases of stations the elevations of which are accurately known and are below 3,200 feet. Each reading is separately corrected and the means of the month are the means of the daily corrected readings.

In table B (2), columns 4 to 11, under the general heading "Pressure, 8 hrs. in inches," are given for each station the 8 hrs. barometric data of the month, including—

(1) The mean 8 hrs. pressure reduced to 32°F., and its departure from the normal mean pressure (reduced to 32°F.) of the month.

(2) The mean 8 hrs. pressure corrected to sea-level and to constant gravity, or to constant gravity only in cases of stations the elevations of which are above 3,200 feet.

(3) The highest and lowest pressures (reduced to 32°F.) recorded during the month with their respective dates of occurrence.

(4) The total range of 8 hrs. pressure during the month, *i.e.*, the difference between the highest and lowest readings.

In Table A, columns 4 to 9, under the general heading "Pressure," are given for all stations recording observations at 10 hrs. and 16 hrs.—

(1) The monthly means of the two hours of observation at 10 hrs. and 16 hrs. reduced to 32°F.

(2) The mean daily range.

(3) The mean of daily mean pressure reduced to 32°F. and its departure from the normal.

(4) The mean of daily mean pressures reduced to 32°F., and corrected to constant gravity and to sea-level, or to constant gravity only in cases of stations the elevations of which are above 3,200 feet.

The means of daily pressures in Table A have been obtained by taking the means of the 10 hrs. and 16 hrs. observations and applying corrections for each month, derived from a series of hourly observations recorded at the same or neighbouring stations, to give true daily means.

The distribution of the mean 8 hrs. pressure of the month is shown on two charts. The first chart (Plate I) gives the distribution of the mean pressure of the month reduced to sea-level and to constant gravity (that of lat. 45°) by means of isobars drawn for differences of pressure 0·05 or $\frac{1}{20}$ of

an inch. The second chart (Plate II) gives the departures from the normal of the actual mean 8 hrs. pressure reduced to 32°F.

The greater part of the normal 8 hrs. daily and monthly means of pressure utilized in Table B of the review have been deduced from the barometric observations of the whole of the twenty-two years period 1889-1910, and in all except 24 cases the periods employed equalled or exceeded five years.

The monthly means employed in the determination of the departures of the mean actual from the mean normal pressures of the month given in Table A are derived from all the available trustworthy pressure data down to 1899 for each station. These normal means are given in the "Indian Meteorological Memoirs," Vol. XVII, pages 66 to 69.

The more important barometric changes and movements during the month are described in the statement of depressions and cyclonic storms of the month. The data that are chiefly used in that discussion are the 8 hrs. reduced observations and the departures derived from comparison of these observations with the normal daily 8 hrs. values.

Barometric pressure in the plains was above normal everywhere except along the west coast from Dwarka to Cochin; the excess was on the whole most pronounced in the Punjab, the United Provinces and Bihar and Orissa, where it averaged ·04" in amount.

TABLE 8.

DIVISION.	Departure from normal of mean 8 hrs. pressure.
	"
Burma	+·023
Assam	+·030
Bengal	+·030
Bihar and Orissa	+·038
United Provinces	+·038
Punjab	+·039
North-West Frontier Province	+·013
Sind	+·018
Rajputana	+·025
Bombay	+·005
Central India	+·024
Central Provinces	+·027
Hyderabad	+·029
Mysore	+·017
Madras	+·021

The vertical gradient was on the whole somewhat weaker than usual in northwest India and rather strong in north-east India and the Peninsula.

TABLE 9.

HILL STATION.	Departure from normal pressure. A	PLAIN STATION.	Departure from normal pressure. B	Departure of pressure difference. B—A.
	"		"	"
Quetta	+·022	Jacobabad	+·019	—·003
Leh	+·052	Lahore	+·039	—·014
Murree	+·051	Peshawar	+·013	—·038
Simla	+·053	Ludhiana	+·043	—·010
Darjiling	+·014	Dhubri	+·034	+·020
Mount Abu	+·037	Deesa	+·020	—·017
Pachmarhi	+·004	Khandwa	+·022	+·018
Kodaikanal	—·012	Madura	+·006	+·018

Temperature.

10. The mean temperature data are given in Tables A and B under the heading "Temperature of air." In Table B they are based upon observations of the dry bulb thermometers recorded at 8 hrs., and of the maximum and minimum thermometers. In the great majority of cases the normals of maximum and minimum temperature for the stations in Table B are derived from the data of the 33 years, 1878—1910; in the case of some of the most recently started observatories the period is shorter, but it is never less than five years. The normals are given in the "Indian Meteorological Memoirs," Volume XXII, Part III, pages 426-457. The monthly mean of the mean between maximum and minimum, as given in this table, differs from the true mean of the day by a small amount which varies from month to month.

It should be noted for the purposes of Table B that the mean temperature of the day really denotes the mean temperature of the 24 hours preceeding 8 hrs. of the day in question and that therefore the month for which the means are given in this table terminates at 8 hrs. of the last day of the month. In the case of Table A, however, the day or 24 hrs. period terminates at midnight (and not at 8 hrs. as in Table B) and the monthly means apply therefore to monthly periods ending at midnight of the last day of the month in question.

In Table A the mean of daily mean temperatures for each month is obtained by taking the mean of the maximum and minimum temperatures and applying a correction given on pages XV to XXI of Volume XVII of the "Indian Meteorological Memoirs." This correction was determined from the hourly observation data given in Volumes V, IX and X of the "Indian Meteorological Memoirs." The data at once furnish the necessary corrections for the stations at which these observations were recorded. At the remaining stations the corrections were determined from the values at the nearest stations with similar condition of exposure, etc., at which the hourly observations were recorded.

The departures from normal of the mean daily mean temperature of the month given in Table A have been obtained by a comparison of the actual means with normal means given in the "Indian Meteorological Memoirs," Volume XVII, pages 16 to 20.

The methods of exposing thermometers will be found fully described in the Hand-book of instructions to observers in India, or briefly in the Annual Report on the Meteorology of India for the year 1887, page 37. All thermometers in use have been verified by comparison with Kew standard thermometers at Calcutta and are re-standardised from time to time: all thermometer readings are corrected to their true values, and hence are strictly comparable.

The mean distribution of temperature in India in each month is exhibited by the help of three charts, which show the departures of the mean maximum, mean minimum and mean daily temperatures from their normal values for the month. These charts are given in Plates III and IV. In them equal departures of temperature are indicated by lines, the lines being drawn for differences of 2 degrees of departure. A continuous line indicates that the temperature was in excess by the amount shown by the number given near the line, and a broken line that it was in defect by the amount indicated by the number similarly placed. The line of no departure, separating areas of excessive from areas of deficient temperature, consists of a continuous and of a broken line placed parallel and near to each other, the broken line being on the side of deficient temperature, and the continuous line on that of excessive temperature. The departures of the temperature of the month from the normal at the hill-stations are given in figures with a positive or negative sign to indicate excess or defect; they are not taken into account when the lines are drawn.

Temperature conditions did not depart to any important extent from the normal. Maximum temperature was inclined to be high in north-west India excluding the North-West Frontier Province and to be low in the Bay Islands, Tenasserim, south Hyderabad, the Madras Deccan, Mysore and the south of the Bombay Deccan. Minimum temperature was slightly higher than usual in Sind, Gujarat and the west of Rajputana and of Central India, and somewhat below normal in Bihar and Orissa, the extreme east of the United Provinces and along the foot of the hills from Roorkee to Peshawar.

The inversion of the normal night temperature relations between the hills and the plains in the extreme north of India, referred to last month, continued to a very marked extent during the first half of January. The minimum temperature of the previous night reported on the morning of the 8th was 15° lower at Peshawar than at Cherat, and on the 9th was 12° lower at Rawalpindi than at Murree.

TABLE 10.

Sub-division.	Actual temperature.				Departure from normal of		
	Mean maximum.	Mean minimum.	Monthly mean of mean between maximum and minimum.	Mean daily range of temperature.	Maximum.	Minimum.	Daily range.
	°	°	°	°	°	°	°
1. Bay Islands	82·3	74·0	78·1	8·3	−2·7	−1·3	−1·4
2. Lower Burma	83·8	64·1	74·0	19·3	−1·8	−1·0	−0·8
3. Upper Burma	79·1	52·4	65·8	26·7	−1·1	−0·5	−0·6
4. Assam	74·2	48·9	61·5	25·2	+0·1	−0·3	+0·4
5. Bengal	76·7	52·9	64·8	23·8	−0·4	−1·1	+0·7
6. Orissa	81·0	55·9	68·4	25·1	−0·7	−2·4	+1·7
7. Chota Nagpur	77·4	49·4	63·4	28·1	−1·1	−1·9	+0·8
8. Bihar	74·1	49·0	61·5	25·2	+0·1	−1·8	+1·9
9. United Provinces, East	74·2	46·7	60·5	27·5	+0·9	−0·9	+1·8
10. Do. do., West	74·7	46·9	60·8	27·9	+2·1	−1·3	3·4
11. Punjab, East and North	69·1	41·4	55·3	27·7	+1·8	−1·4	+3·2

Sub-division.	Actual temperature.				Departure from normal on		
	Mean maximum.	Mean minimum.	Monthly mean of mean between maximum and minimum	Mean daily range of temperature.	Maximum.	Minimum.	Daily range.
	°	°	°	°	°	°	°
12. Punjab South-west	70·7	42·0	56·3	28·7	+2·4	+1·0	+1·4
13. Kashmir	42·2	19·3	30·7	22·9	+3·9	+1·1	+2·8
14. North-West Frontier Province	66·1	39·1	52·6	26·9	+0·3	−0·8	+1·1
15. Baluchistan	60·6	37·5	49·0	23·1	+2·3	−0·3	+2·6
16. Sind	76·6	53·5	65·0	23·0	+1·6	+2·8	−1·2
17. Rajputana, West	76·9	49·5	63·1	27·4	+2·6	+3·1	−0·5
18. Do., East	76·4	49·3	62·9	27·1	+1·7	+1·2	+0·5
19. Gujarat	84·0	57·4	70·7	26·6	+2·2	+2·8	−0·6
20. Central India, West	79·7	51·5	65·6	28·2	+1·3	+2·5	−1·2
21. Do. do., East	74·7	46·3	60·5	28·3	+0·3	−1·3	+1·6
22. Berar	83·7	57·8	70·8	25·9	−0·5	+1·4	−1·9
23. Central Provinces, West	80·1	52·5	66·3	27·6	−0·1	+0·5	−0·6
24. Do. do., East	80·9	52·7	66·8	28·2	−0·3	−0·5	+0·2
25. Konkan	85·3	68·0	76·7	17·3	+0·1	+0·6	−0·5
26. Bombay Deccan	84·4	56·0	70·2	28·4	−1·3	+0·2	−1·5
27. Hyderabad, North	83·7	58·0	70·9	25·7	−1·1	+0·6	−1·7
28. Do., South	83·8	60·6	72·2	23·2	−2·5	−1·1	−1·4
29. Mysore	81·3	58·1	69·7	23·2	−1·7	−0·8	−0·9
30. Malabar	87·8	70·4	79·1	17·4	+0·4	−0·4	+0·8
31. Madras, South-east	84·3	67·8	76·1	16·5	−1·0	+0·2	−1·2
32. Do. Deccan	86·6	61·8	74·2	24·9	−2·0	−0·6	−1·4
33. Do. Coast, North	81·8	63·7	72·8	18·1	−0·7	−1·6	+0·9

TABLE 11.

Division.	Departure from normal of		
	Mean maximum temperature.	Mean minimum temperature.	Mean temperature.
	°	°	°
Burma	−1·5	−0·8	−1·1
Assam	+0·1	−0·3	−0·1
Bengal	−0·4	−1·1	−0·7
Bihar and Orissa	−0·4	−2·0	−1·2
United Provinces	+1·4	−1·0	+0·2
Punjab	+2·0	−0·7	+0·6
North-West Frontier Province	+0·3	−0·8	−0·3

Division.	Departure from normal of		
	Mean maximum temperature.	Mean minimum temperature.	Mean temperature.
	°	°	°
Sind	+1·6	+2·8	+2·2
Rajputana	+1·9	+1·7	+1·8
Bombay	+0·6	+1·4	+1·0
Central India	+0·8	+0·6	+0·7
Central Provinces	−0·2	+0·4	+0·1
Hyderabad	−1·9	−0·4	−1·1
Mysore	−1·7	−0·8	−1·3
Madras	−0·8	−0·5	−0·6

Winds.

11. The 8 hrs. wind data, consisting of observations of the direction of the wind and of the air movement as registered by Robinson anemometers, are given in Table B under the heading "Wind direction," "Wind velocity" and "Wind steadiness." In these columns are shown the number of days the wind at 8 hrs. blew from each of eight points, and the resultant direction of the wind, the mean hourly air movement and the steadiness derived from these observations. The wind resultant is calculated in all cases by the use of *Lambert's formula*, in which equal values are given to each wind observation irrespective of velocity. The mean wind directions are shown in *Plate* I by means of arrows in the usual manner.

The wind data for 10 hrs. and 16 hrs. are given in a similar form in Table A. Under the heading "Wind direction" are shown the number of times that each of eight wind directions was observed at the hours of record, and the directions of the resultant of winds of unit strength in these directions. The ratio of the magnitude of the resultant so obtained to that which it would have if the wind always blew from the same direction (*i.e.*, throughout the whole of the observations), is called the wind steadiness and is given as a percentage, with a table of normals, under the heading "Wind steadiness." The mean diurnal movement of the air at each station and the average monthly value are to be found under the heading "Wind velocity."

The figures of the normal values for wind used in Tables A and B are computed from all available data previous to 1899, or in some cases 1902, and have been published in Volume XVII of the "Indian Meteorological Memoirs."

All anemometers used in India are compared before issue with the standard Beckley anemograph at Calcutta Observatory, but as only the instruments with small corrections are issued no correction has been applied to the values given in Tables B and C.

Hitherto the factor representing the ratio of air movement to travel of Beckley cups had in India, as in other countries, been taken as 3·0; but as in 1911 it had been generally accepted that the factor should be 2·2 the change to 2·2 was made in the Monthly Weather Review of January 1912 (see note on page 8 there).

(*a*) As might be expected from the absence of cold weather storms the winds were lighter than usual in most parts of Northern India as well as in Hyderabad and Bombay. In Mysore and Madras, on the other hand, the velocity was above normal.

(*b*) The steadiness was decidedly low in Bengal and the North-West Frontier Province, and about the average or greater than usual elsewhere; it was remarkably high in Assam, the Punjab and Hyderabad.

(*c*) The normal northerly element in the mean wind direction was appreciably weak in Burma, Central India and Rajputana. It is noteworthy that at the level of Leh calms or light north-east winds prevailed throughout the month to the entire exclusion of the usual southerly winds.

TABLE 12.

DIVISION.	DEPARTURE FROM NORMAL OF	
	Hourly wind velocity.	Wind steadiness.
Burma	+0·2	+ 6
Assam	0	+20
Bengal	—0·3	—11
Bihar and Orissa	—0·1	+ 3
United Provinces	—0·5	+ 3
Punjab	+0·1	+11
North-West Frontier Province	—0·9	— 7
Sind	—1·4	+10
Rajputana	—0·5	+ 6
Bombay	—0·5	+ 4
Central India	—0·7	— 4
Central Provinces	0	+ 7
Hyderabad	—0·7	+27
Mysore	+1·6	+14
Madras	+1·3	+ 7

Humidity and Cloud.

12. The hygrometric data of the month registered at certain stations are given in Table A. In that table appear columns giving the means of the wet bulb readings at 10 hrs. and at 16 hrs., of the minimum wet bulb readings, of the vapour tension and humidity at the same hours, and also the mean of daily means of these elements and of its departure from the normal mean. The hygrometric data are taken from the departmental "Tables for the reduction of meteorological observations." The means of daily means are obtained by taking the means of the minimum, 10 hrs. and 16 hrs. observations and reducing them to true means, by applying, in case of vapour tension, the corrections given on pages XXXVIII to XLII, and in case of humidity the corrections given on pages XLIV to XLVIII of Volume XVII of the "Indian Meteorological Memoirs." These corrections were determined from the hourly observation data given in Volumes V, IX and X of the "Indian Meteorological Memoirs." The normal values, which have been used for obtaining the departures, are the means calculated in the same way.

The distribution of humidity in each month in India is exhibited by means of two charts in Plate V. The first chart shows the departure from normal of 8 hrs. absolute humidity, and the second that of the relative humidity.

The proportion of cloud is estimated in tenths of the sky expanse, an overcast sky being denoted by 10 and a cloudless sky by 0. The monthly means in Table A are the arithmetical means of the cloud amounts at 10 hrs. and 16 hrs., and the normal means, with which the actual monthly means are compared, are derived from the available cloud data for the same hours.

The departure from normal of the mean distribution of cloud amount at 8 hrs. in each month in India is shown in chart No. 1 of Plate VI, and the discussion of this and of

the hygrometric features is based on the data given in Table B.

Normal values for most of the stations in Table B have been derived from the 8 hrs. records of the period 1889-1910.

The air was damper than usual, both absolutely and relatively, in Sind, but in the other divisions the hygrometric conditions were sensibly normal.

Skies were unusually cloudy over the greater part of Burma and of the south of the Peninsula, but elsewhere the cloud amount was either about the average or in defect.

TABLE 13.

DIVISION.	HYGROMETRY; 8 HRS.				CLOUD.	
	Mean humidity.	Departure from normal.	Mean vapour tension in inches of mercury.	Departure from normal in inches of mercury.	Mean cloud amount at 8 hrs.	Departure from normal.
	%					
Burma . .	83	— 1	·506	—·029	3·2	+1·2
Assam . . .	92	— 2	·384	—·025	3·9	+0·2
Bengal . . .	84	— 2	·408	—·028	1·4	—0·3
Bihar and Orissa .	77	— 2	·356	—·031	1·2	—0·8
United Provinces .	78	— 3	·300	—·011	2·0	—0·4
Punjab . .	76	— 2	·238	—·009	3·2	—0·4
North-West Frontier Province.	75	+ 4	·213	+·007	4·3	+0·3
Sind . . .	72	+11	·334	+·058	2·3	—0·5
Rajputana . .	56	— 2	·238	+·004	2·5	—0·1
Bombay . .	62	+ 1	·401	+·012	1·2	—0·1
Central India .	68	+ 2	·294	+·004	1·8	—0·4
Central Provinces .	64	+ 1	·337	+·011	1 5	—0·3
Hyderabad . .	66	+ 2	·439	—·007	2·7	—0·4
Mysore . .	71	— 1	·437	—·038	3·6	+0,5
Madras . .	77	— 3	·597	—·041	2·9	+0·1

Rainfall.

13. Rainfall observations are made at about 2,900 stations in India. The time of observation is 8 hrs. The rainfall data for each province are tabulated in the office of the local Meteorologist, Director of Land Records, or other officer in the province, and are published in the provincial gazettes.

The charts illustrating the distribution of rainfall in the month under discussion are based in part upon the rainfall data of the meteorological observatories throughout India, and in part upon the rainfall statements of the month published by the Local Governments.

Plate VII is based on all the rainfall data available at the time of publication and shows the normal average rainfall and the departure of the rainfall from the normal of the month in the 33 meteorological or rainfall divisions.

The distribution of the total number of rainy days in each month is exhibited in chart No. 2 of Plate VI, and is based entirely on the data furnished by the meteorological observatories. A "rainy day" is one on which 0·10 inch or more of rain is received within 24 hours.

The normal figures of rainfall, and of the number of "rainy days," in Table B are based on observations which extend in most cases over a period of 40 or 50 years ending in 1910.

Precipitation was either wanting or lighter than usual in all parts of India with the exception of Lower Burma and Central India, West. The defect ranged between half an inch and one inch in Orissa, Chota Nagpur, the United Provinces, West, the Punjab, East and North and the North-West Frontier Province; it was as much as 2″ or 55 per cent. in Kashmir.

TABLE 14.

SUB-DIVISION.	NUMBER OF RAINY DAYS.		RAINFALL.			
	Actual.	Normal.	Actual.	Normal.	Departure from normal.	Percentage departure from normal.
			″	″	″	
1. Bay Islands	0·5	1·1	0·24	0·65	—0·41	— 63
2. Lower Burma	0·2	0·2	0·10	0·09	+0·01	+ 11
3. Upper Burma	0	0·3	0·02	0·11	—0·09	— 82
4. Assam	0·7	2·0	0·47	0·77	—0·30	— 39
5. Bengal	0	0·9	0·02	0·44	—0·42	— 95
6. Orissa	0	0·9	0·01	0·51	—0·50	— 98

Sub-division.	Number of rainy days.		Rainfall.			
	Actual.	Normal.	Actual.	Normal.	Departure from normal.	Percentage departure from normal.
			"	"	"	
7. Chota Nagpur	0·2	1·8	0·06	0·92	—0·86	— 93
8. Bihar	0·4	1·2	0·11	0·59	—0·48	— 81
9. United Provinces, East	1·0	1·4	0·28	0·68	—0·40	— 59
10. Do. do., West	1·0	2·0	0·37	0·94	—0·57	— 61
11. Punjab, East and North	1·0	2·2	0·31	1·23	—0·92	— 75
12. Punjab, South-west	0·5	1·2	0·13	0·49	—0·36	— 73
13. Kashmir	3·6	5·0	1·71	3·76	—2·05	— 55
14. North-West Frontier Province	2·0	2·6	0·70	1·54	—0·84	— 55
15. Baluchistan	3·3	2·7	1·18	1·25	—0·07	— 6
16. Sind	0	0·7	0·03	0·27	—0·24	— 89
17. Rajputana, West	0·2	0·4	0·06	0·14	—0·08	— 57
18. Do., East	0·4	0·9	0·16	0·35	—0·19	— 54
19. Gujarat	0	0·1	0·03	0·04	—0·01	— 25
20. Central India, West	1·0	0·7	0·51	0·30	+0·21	+ 70
21. Do., East	0·5	1·1	0·15	0·51	—0·36	— 71
22. Berar	0·2	0·6	0·04	0·31	—0·27	— 87
23. Central Provinces, West	0·4	1·0	0·18	0·47	—0·29	— 62
24. Do., East	0·1	0·8	0·04	0·35	—0·31	— 89
25. Konkan	0	0·2	0	0·10	—0·10	—100
26. Bombay Deccan	0	0·3	0	0·12	—0·12	—100
27. Hyderabad, North	0	0·3	0·01	0·12	—0·11	— 92
28. Do., South	0	0·3	0	0·16	—0·16	—100
29. Mysore	0	0·2	0·01	0·11	—0·10	— 91
30. Malabar	0	0·5	0	0·29	—0·29	—100
31. Madras, South-east	1·2	1·2	0·70	0·84	—0·14	— 17
32. Do., Deccan	0·1	0·2	0·05	0·16	—0·11	— 69
33. Do., Coast, North	0·1	0·3	0·07	0·35	—0·28	— 80

Table 15.

Division.	Rainfall.			
	Actual.	Normal.	Departure from normal.	Percentage departure from normal.
	"	"	"	
Burma	0·05	0·10	—0·05	— 50
Assam	0·47	0·77	—0·30	— 39
Bengal	0·02	0·44	—0·42	— 95
Bihar and Orissa	0·07	0·65	—0·58	— 89
United Provinces	0·33	0·82	—0·49	— 60
Punjab	0·26	1·05	—0·79	— 75
North-West Frontier Province	0·70	1·54	—0·84	— 55

Division.	Rainfall.			
	Actual.	Normal.	Departure from normal.	Percentage departure from normal.
	"	"	"	
Sind	0·03	0·27	—0·24	— 89
Rajputana	0·13	0·29	—0·16	— 55
Bombay	0·01	0·09	—0·08	— 89
Central India	0·33	0·40	—0·07	— 17
Central Provinces	0·09	0·38	—0·29	— 76
Hyderabad	0	0·14	—0·14	—100
Mysore	0·01	0·11	—0·10	— 91
Madras	0·38	0·57	—0·19	— 33
Mean of India	0·16	0·46	—0·30	— 65

Snowfall.

I.—Afghanistan.

14. Snow to a total depth of about one foot is reported to have fallen on the hills near Kabul.

II.—North-West Frontier Province.

(*a*) *Wano.*—The statement below shows the character of snowfall in this area :—

Table 16.

Locality.	Elevation in feet.	Number of falls.	Total amount.	
			Ft.	Ins.
Pirghal and Marwatti . .	11,000	6	1	4
Jani Mela and Kundighar .	9,000	5	0	11
Kotkun	7,900	5	0	8

By the end of the month the snow had almost disappeared except from the highest peaks of Pirghal and Marwatti.

(*b*). *Tochi* (*North Waziristan*).—Moderate falls occurred on the Vezhda hill on the 22nd and 25th.

(*c*) *Kohat.*—On the Samana range snow fell on the 14th, 21st, 23rd and 26th to a total depth of 2⅓ ft.

(*d*) *Hazara.*—The following statement indicates the character of snowfall in this area :—

Table 17.

Locality and its elevation.	Total amount of snowfall during the month.		Number of days on which snow fell.	Depth of unmelted snow on 15th January.	
	Ft.	In.		Ft.	In.
Narang . . . 8,000	8	0	6	*nil.*	
Paludrán . . . 7,300	6	2	6	*nil.*	
Kagan . . . 6,600	3	9	6	*nil.*	
Jared . . . 5,000	0	5	1	*nil.*	
Malkandi . . . 4,500	0	4	1	*nil.*	
Sundigali . . . 7,000	4	4	5	0	8
Jachha . . . 6,500	3	5	5	0	5
Dungagali . . . 8,000	3	2½	6	0	3
Thandiani . . . 8,800	4	9	9	0	9

III—Kashmir.

The character of the snowfall in this area is indicated by the statement below :—

Table 18.

Locality.	Number of falls.	Total amount.	Remarks.
Dras	10	About 11 inches.	
Srinagar	8	About 7 inches.	
Skardu	4	About 2 inches...	Altogether ten falls occurred on the surrounding hills.
Kargil	5	Not known but probably small.	On the surrounding hills there were nine falls and at the end of the month the unmelted residue varied between 2″ and 2′.

IV.—Punjab.

(*a*) *Murree and the hills adjacent to Kahuta.*—In Murree snow fell on nine days, giving a total fall of 1¼′ with a maximum on any single day of 6″. The fall did not extend to the hills adjacent to Kahuta.

(*b*) *Kilba* (*Simla Hills*).—On the ranges near Kilba light snowfall occurred on the 10th, 11th, 13th to 15th, 21st, 23rd, 24th and 26th to 28th ; the snow line descended to a level of 7,000 feet on the 21st, 27th and 28th.

Table 19.

Name of pass or peak.	Depth of accumulation at the end of the month.	
	Reported.	Normal.
	Feet.	Feet.
Shatul	6	10
Braa	6	9½
Rupin	5	9½
Harang	1?	6

V.—United Provinces.

(*a*) *Garhwal.*—Snow to a depth of about two inches fell on the highest peaks in the north of the district.

(*b*) *Almora.*—The total fall of the month was estimated at 5¼′ in Malla Darma, 4′ in Byans, 3½′ in Chaudas, 1¾″ in Malla Johar and 1¼″ in Malla Danpur. The lowest descent below the level of the perpetual snows was to a distance of five miles in Byans.

TABLE 20.

Name of pass or peak.	Depth of accumulation at the end of the month.	
	Reported.	Normal.
	Feet.	Feet.
Nuwe Pass	8	34
Lampia „	8	14½
Lipulekh „	6	16
Binkaru „	5½	19
Pindari Peak	1	8
Kaphini „	1	7½
Kuntela „	1	7½
Millamdhura	1	12
Bagelwar	½	...

VI.—NORTH-EAST HIMALAYAS.

Sikkim.—There was a total fall of about 2 inches at Yatung.

NORTH-EAST FRONTIER TRACT.

(*a*) *Western Section.*—Unusually heavy snow fell in the early part of the month and closed for a month the Sela and the Tsela between the Tawang and Dirang as well as the upper road from Tawang to Tsona Jong.

(*b*) *Central and Eastern Sections.*—Snow fell steadily during the first three weeks down to about 7,000 feet.

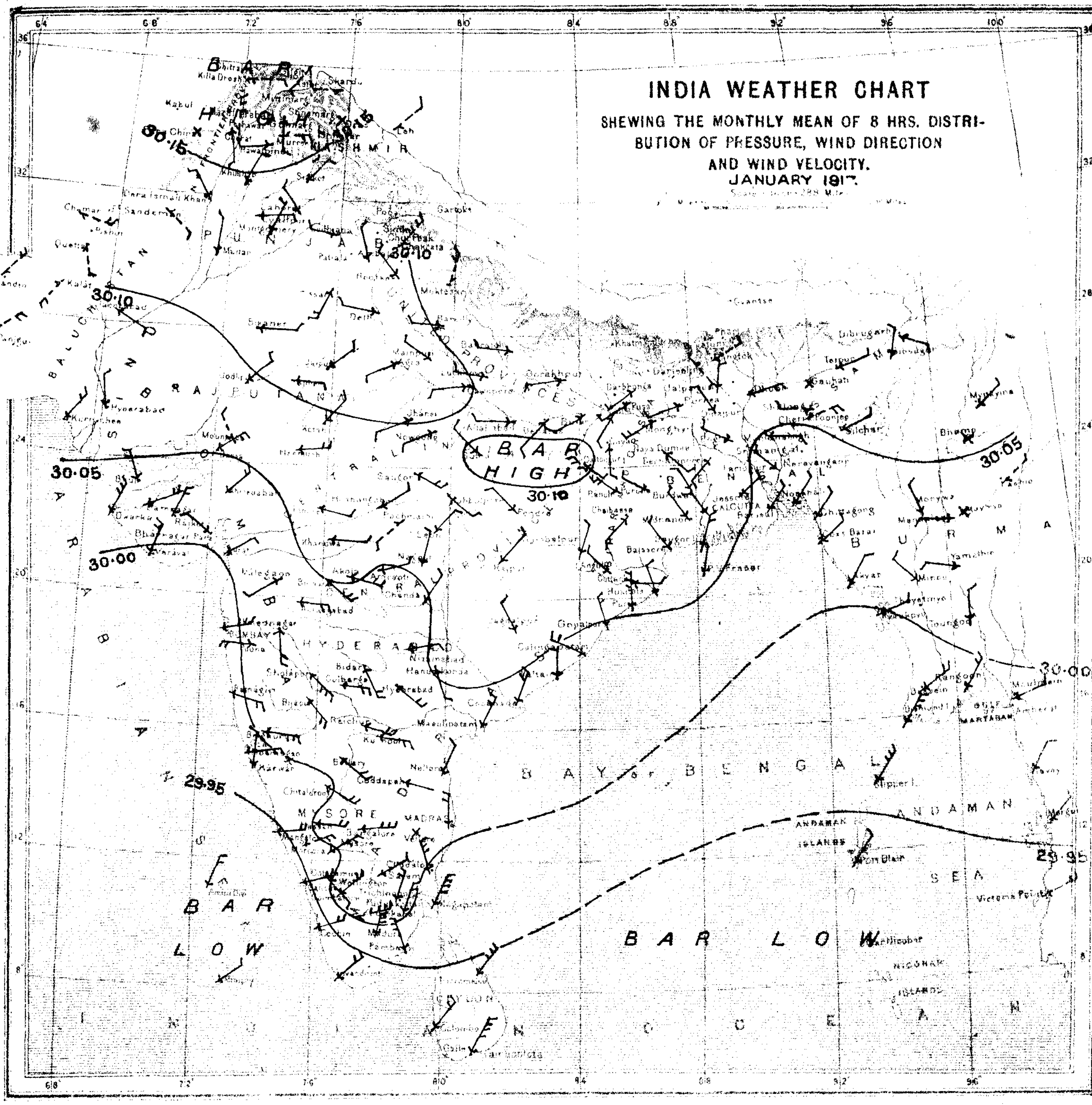
(*c*) *Kamrup.*—About one foot of snow fell on the Dingdeng and about six inches on the Ongla. There was no snowfall on the Omkhar, Brangdom and Tongsa.

SUMMARY.

15. (*a*) In the mountain zone bordering Upper India there was on the whole considerably less snowfall than usual, and at the end of the month the unmelted residue of the accumulations was in general distinctly below the average.

(*b*) Unusually heavy snow is reported to have fallen in parts of the North-east Himalayas.

HEM RAJ.



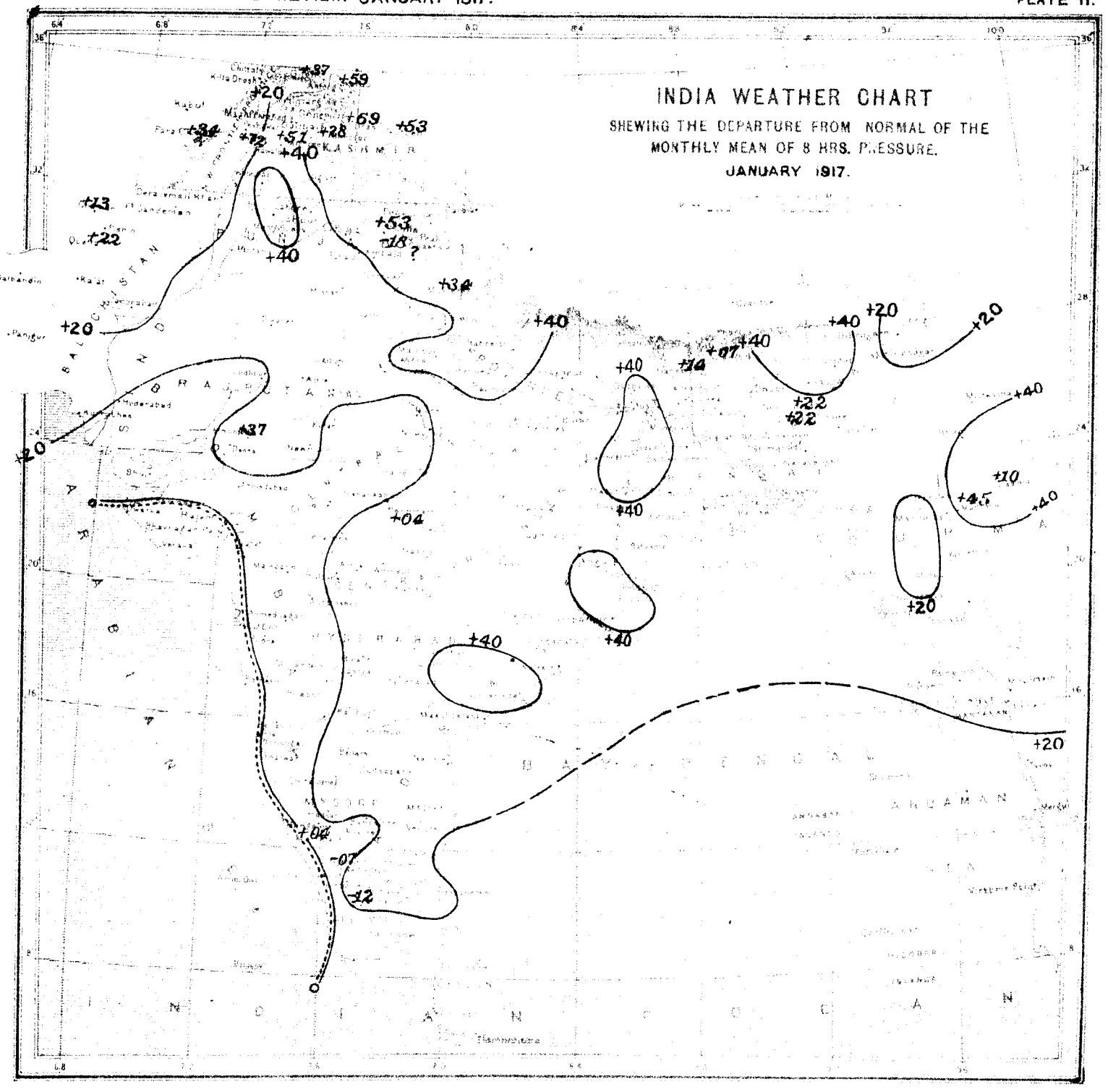
N. L. Holder.

The lines of the shore chart represent isobars or lines of equal barometric pressure, the numbers attached indicating the barometric pressure in inches and being drawn for differences of pressure of ·05 inch. The isobars in the Bay of Bengal are filled in by means of the shore observations, and by comparison with the normal distribution of pressure.

The mean 8 hrs. wind directions of the month are shewn by means of arrows flying with the wind, and are calculated by means of Lambert's formula applied to the winds as given in Table B of the 8 hrs. observations. The mean wind directions for the hill stations are indicated by broken arrows to distinguish them from the wind arrows for the plain stations. The mean velocity of the winds during the month is shewn by the following notation:—

Velocity of 0 to 2 miles per hour	...	one feather added to the wind arrow.
,, ,, 2 to 5 ,, ,, ,,	...	two feathers ,, ,, ,, ,,
,, ,, 5 to 10 ,, ,, ,,	...	three ,, ,, ,, ,, ,,
,, ,, 10 to 20 ,, ,, ,,	...	four ,, ,, ,, ,, ,,
over 20 ,, ,, ,,	...	five ,, ,, ,, ,, ,,

Wind strengths are based on factor 2·2 for the standard type of Beckley Robinson anemograph, instead of 3·0 as used for this plate up to December 1911 inclusive.



The chart shows the departure from normal of the mean during the month of 8 hrs. pressure by means of lines drawn for equal amounts of departure. The numbers are given in thousandths of an inch, 20 representing '020' or two hundredths of an inch, &c. Continuous lines indicate that the pressure was in excess by amounts indicated by the numbers attached to the lines, and broken or dotted lines that it was in defect by amounts indicated by the numbers attached to the lines. Two parallel lines near to each other, one continuous and the other broken or dotted, represent the line of no departure, the dotted line facing the area of deficient pressure or negative departures.

CHART SHEWING THE DEPARTURE FROM NORMAL
OF THE MONTHLY MEAN OF DAILY
MAXIMUM TEMPERATURE.

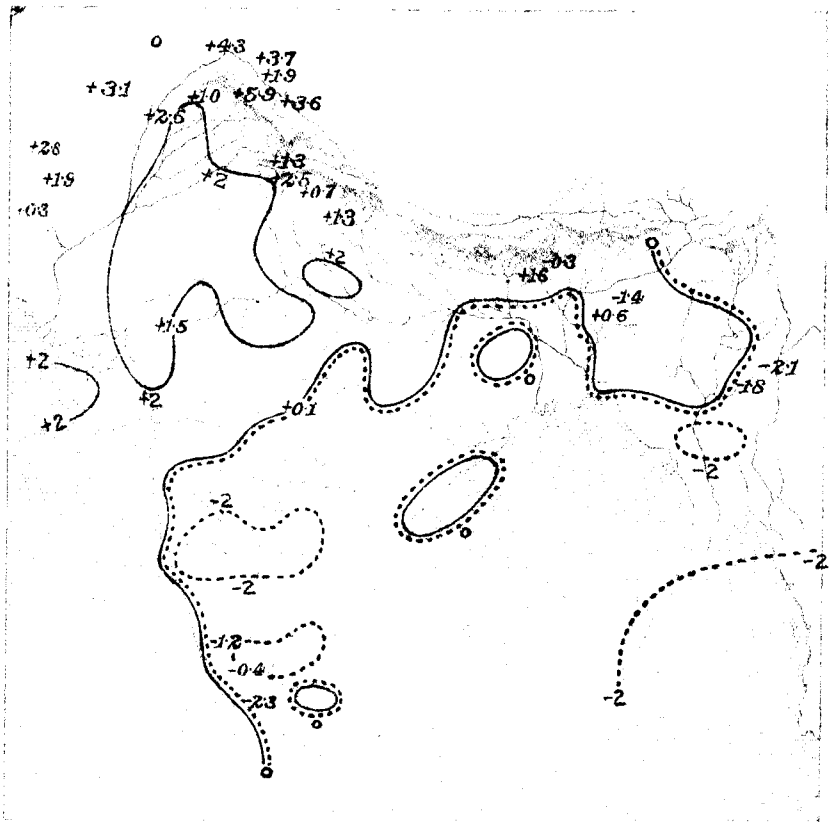


CHART SHEWING THE DEPARTURE FROM NORMAL
OF THE MONTHLY MEAN OF DAILY
MINIMUM TEMPERATURE.

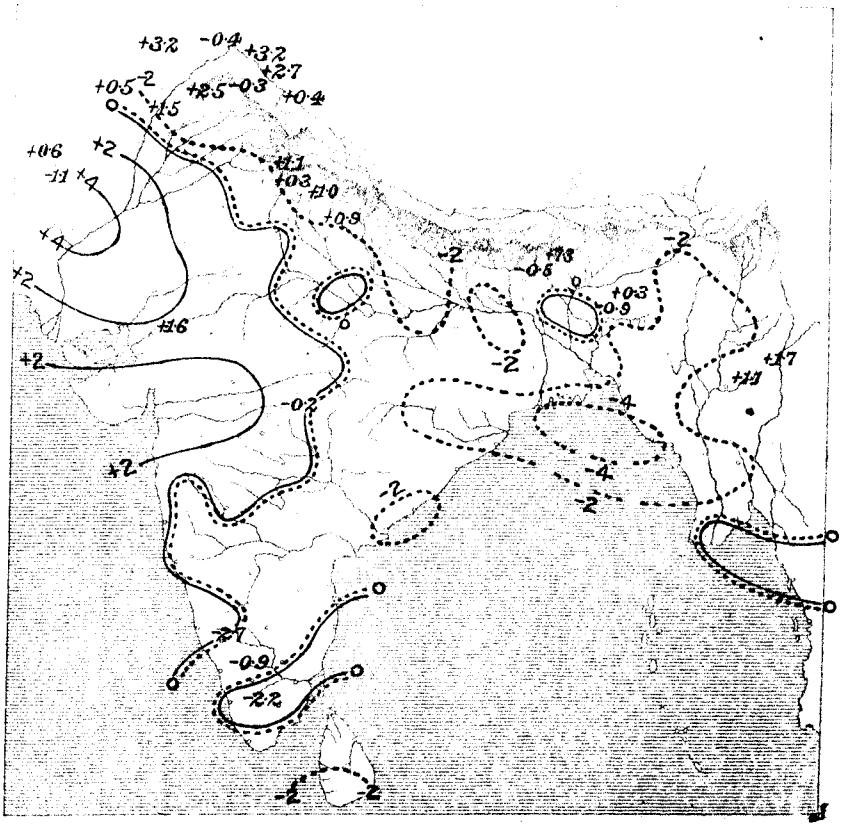


CHART SHEWING THE DEPARTURE FROM NORMAL
OF THE MONTHLY MEAN OF DAILY
MEAN TEMPERATURE.

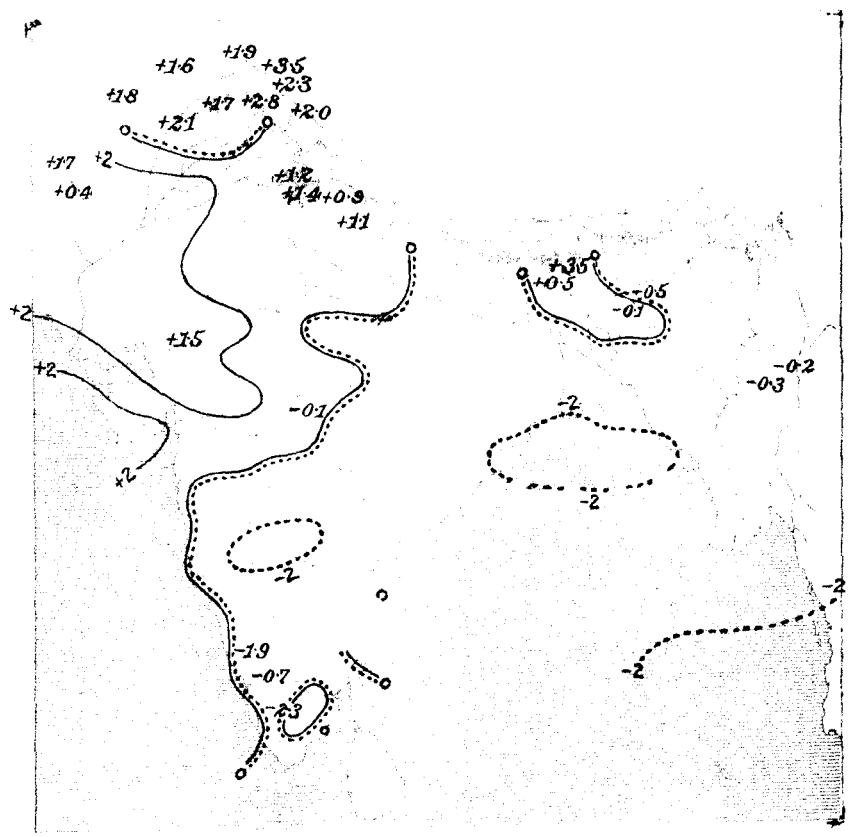


CHART SHEWING THE DEPARTURE FROM NORMAL
OF THE MONTHLY MEAN OF ABSOLUTE
HUMIDITY AT 8 HRS.

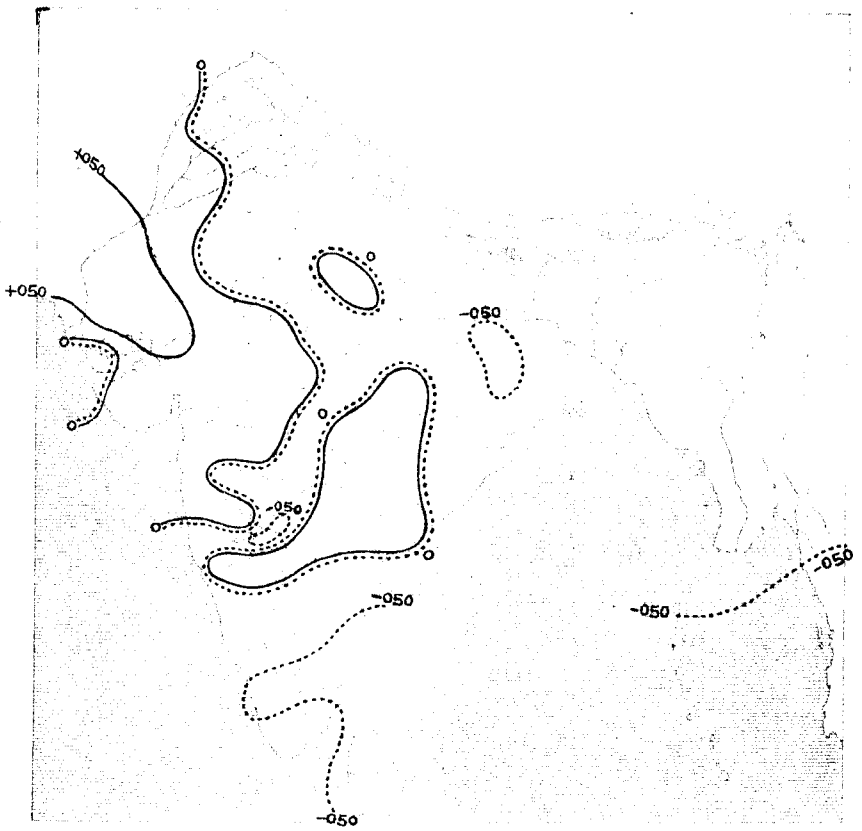


CHART SHEWING THE DEPARTURE FROM NORMAL
OF THE MONTHLY MEAN OF RELATIVE
HUMIDITY AT 8 HRS.

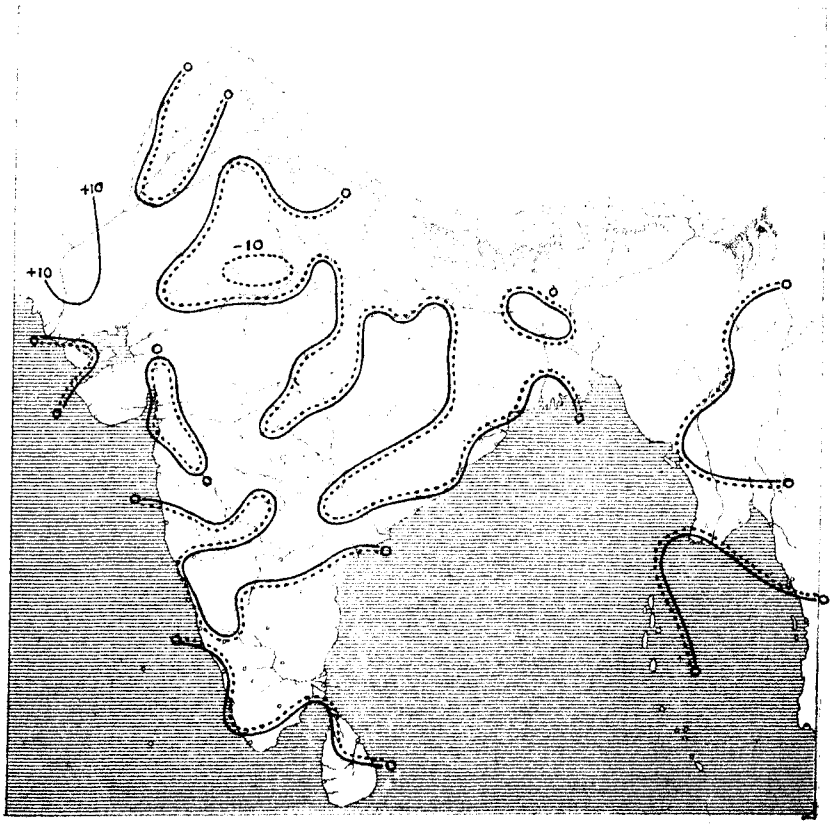


CHART SHEWING THE DEPARTURE FROM NORMAL
OF THE MONTHLY MEAN OF CLOUD
AMOUNT AT 8 HRS.

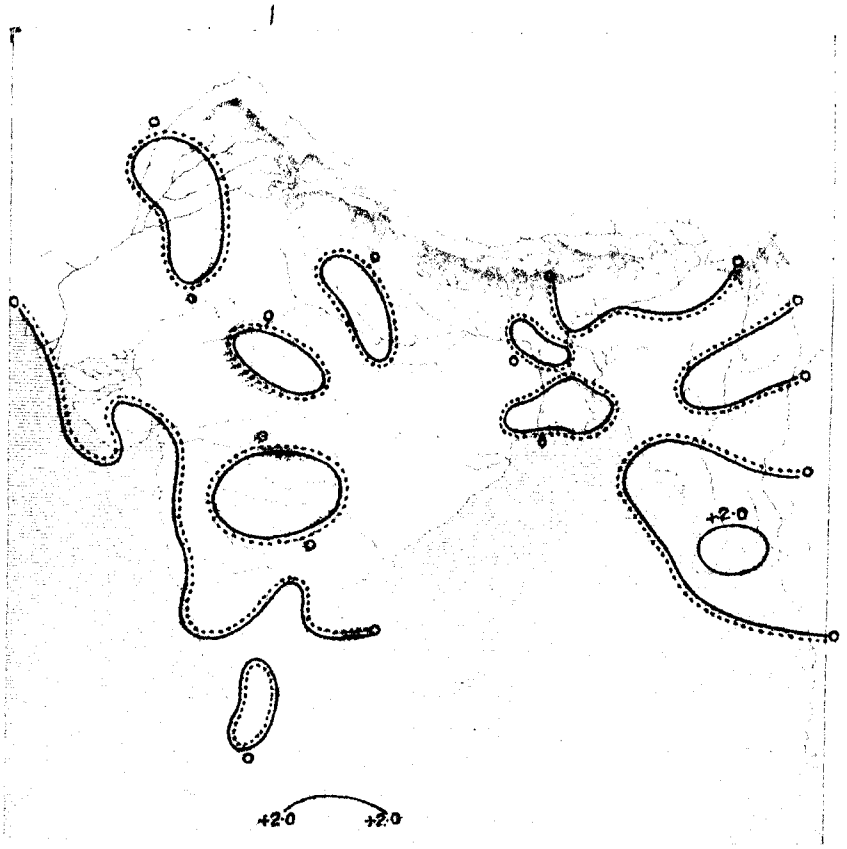
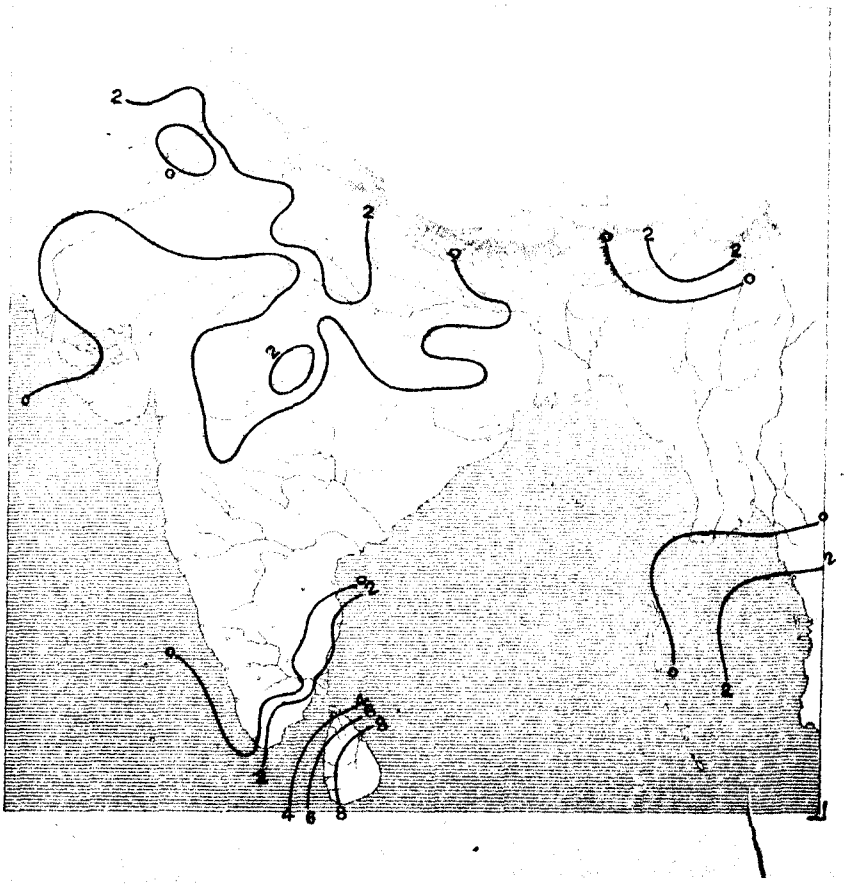
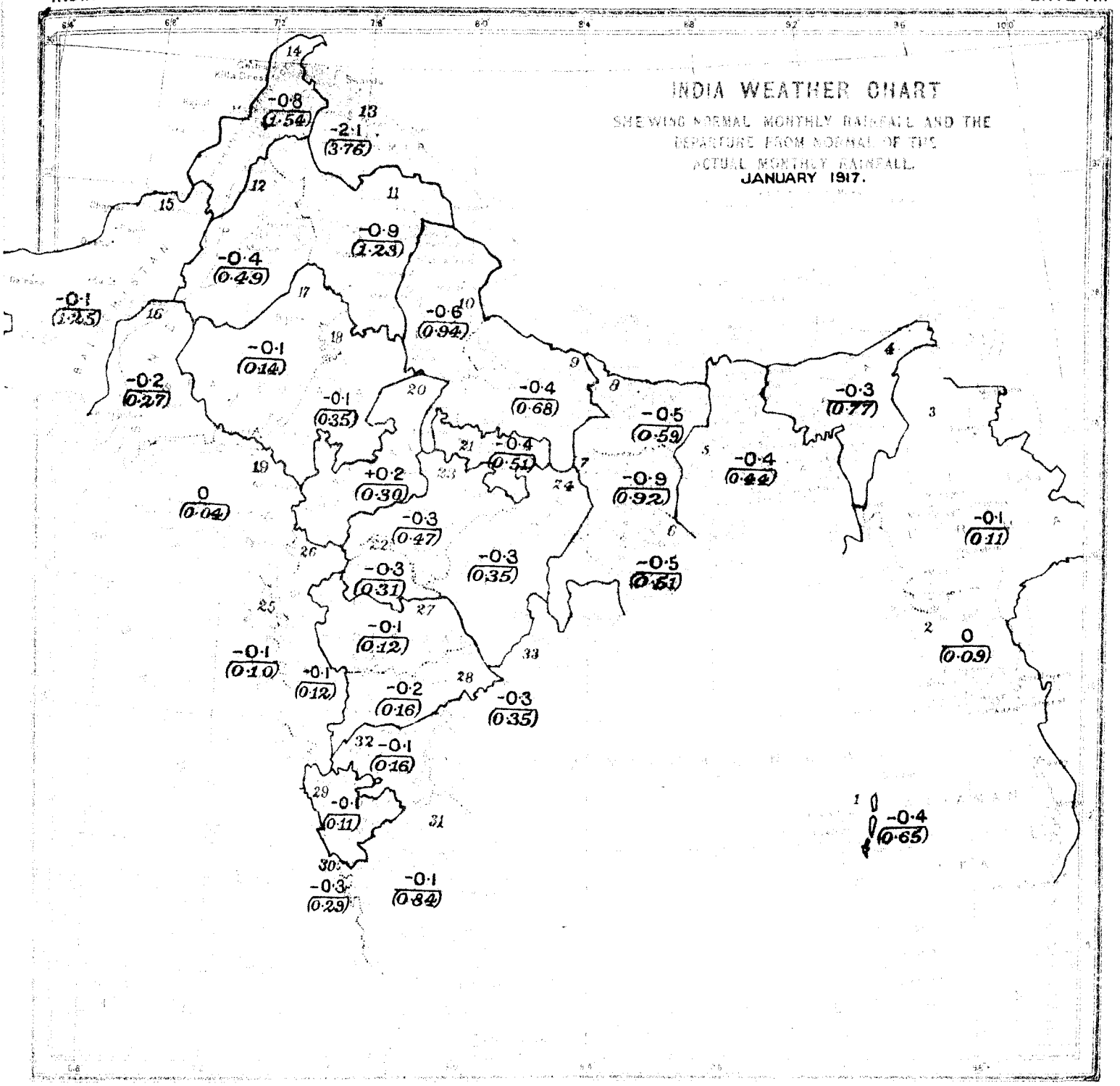


CHART SHEWING THE TOTAL NUMBER OF DAYS IN THE
MONTH ON WHICH RAINFALL EQUALLED OR
EXCEEDED 0·01 INCH.
(BASED ON THE RETURNS OF TABLE B.)





The country is divided into 33 areas as shown in the list below. The numbers in that list correspond with the red numbers on the chart, and serve to identify the areas. The numbers in brackets on the chart give the average over the divisions of the normal monthly rainfall, the numbers above these give the departures from normal of the average actual rainfall over the divisions.

1. Bay Islands
2. Lower Burma
3. Upper Burma
4. Assam
5. Bengal
6. Orissa
7. Chota Nagpur
8. Bihar
9. United Provinces, East
10. United Provinces, West
11. Punjab, East and North
12. Do., Southwest
13. Kashmir
14. Northwest Frontier Province
15. Baluchistan
16. Sind
17. Rajputana, West
18. Rajputana, East
19. Gujarat
20. Central India, West
21. Do., East
22. Berar
23. Central Provinces, West
24. Do., East
25. Konkan
26. Bombay, Deccan
27. Hyderabad, North
28. Hyderabad, South
29. Mysore
30. Malabar
31. Madras, Southeast
32. Madras, Deccan
33. Madras Coast, North

GOVERNMENT OF INDIA.

METEOROLOGICAL DEPARTMENT.

MONTHLY WEATHER REVIEW.

PUBLISHED BY ORDER OF

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CALCUTTA, FEBRUARY, 1917.

INTRODUCTION.

THIS review of the weather in India during the month of February, 1917, is based on observations taken daily at 8 hrs. at 214 stations, and on additional observations taken at 10 hrs. and 16 hrs. at 12 stations. In the rainfall summary the data furnished by the meteorological observatories, and the rainfall statements of the month published by the Provincial Governments, have been utilized.

The brief notes on solar, magnetic and seismic disturbances are supplied by the chief observatories.

For a statement of the methods adopted in recording and tabulating the data, for each of the elements of observation, reference should be made to the introductory portion of the review for January.

Summary of the chief features of the weather in India during the month.

2. Several disturbances were transmitted into India from the west, but they failed to give rainfall of any importance over the greater part of north-west India. On the other hand remarkably wet weather occurred in the Peninsula and the central parts of the country, and the rainfall of the month was far above the average in those areas as well as locally in north-east India.

The cloud proportion was very high in Burma, Assam, Bengal and the greater part of the Peninsula, and was low generally in north-west India. Relative humidity was in appreciable defect in the North-West Frontier Province, the Punjab and the adjoining districts of Rajputana, and was higher than usual in Orissa, the Central Provinces, Central India, Hyderabad, Mysore and the greater part of the Bombay Presidency. Maximum temperature exceeded the normal by about 7° in Baluchistan and Kashmir, 6° in the Punjab and the North-West Frontier Province, 5° in Sind and west Rajputana, and was below the average by 5° in the Madras Deccan, 4° in Hyderabad and Mysore and 3° in Upper Burma, Orissa and the Central Provinces. Minimum temperature was within 3° of the normal in all the sub-divisions with the exception of Kashmir where it was nearly 4° higher than usual.

Barometric pressure in the plains of India as a whole was in defect by ·033".

Solar, magnetic and seismic disturbances.

KODAIKANAL OBSERVATORY.

3. *Solar Observations.*—Observations of the sun for spots, faculae, and prominences were made on all the days except two during the month.

Sunspots.—Twenty-eight new groups of spots were observed as against thirty-two in January. The daily average number was 5·0 and the average life of a spot was 5·0 days, the averages for the preceding month being 6·0 and 4·8 respectively. The distribution of the spots in latitude was as follows :—

TABLE 1.

—	0°—10°	11°—20°	21°—30°	Mean latitude.	Extreme latitudes.
North . . .	2	6	5	18°·4	7° & 29°
South . . .	2	6	7	17°·9	6° & 28°

Two small dots which appeared on the 4th near the east limb of the sun at latitude —16° rapidly developed into a very large group before reaching the central meridian. This group was visible until the 16th when it went round the west limb of the sun. Displacements and reversals of the C line were frequent near the group.

Prominences.—Ninety-two large, four eruptive, and four metallic prominences were recorded during the month. Prominences reaching a height of 180″ were observed on the 12th, 13th, and 16th, and this was the greatest height recorded.

Magnetic disturbances.—"Great" disturbances were recorded on the 15th and 16th and on the 20th; "moderate" disturbances occurred on the 18th and 19th.

J. EVERSHED,
Director,
Kodaikanal and Madras Observatories.

Seismic records.

$\phi = 10° 13' 50''$; $\lambda = 77° 28' 00''$; $h = 2343$ m. *Subsoil Rock.*

Apparatus.—Milne's Horizontal Pendulum Seismograph.

TABLE 2.

	V	To	ϵ	$\frac{r}{To^2}$
AN:				
AE:	9·76	2·6	1	17·0
AZ:				

Date.	Phase.	Time G. M. T.	Period (Sec.).	Amplitude (u). AN.	AE.	AZ.	Distance Δ (Km.).	Remarks.
1917.		h. m. s.						
Feb. 12th	e P	9 26 42	...	...	..	...	...	Widening of line.
	F	10 34 18	...	...	...	...	...	
„ 15th	e P	2 00 00	...	...	...	...	...	
	i L	2 04 48	...	...	...	...	...	
	M	2 34 06	...	...	150	...	...	
	F	3 10 12	...	...	...	...	...	
„ 18th	e P	1 38 06	...	...	...	...	...	Widening of line.
	F	2 09 18	...	...	...	...	...	
„ 20th	e P	20 10 30	...	...	...	...	...	
	F	20 42 24	...	...	...	...	...	
„ 21st	e P	10 57 18	...	...	...	...	...	Widening of line.
	F	11 44 00	...	...	...	...	...	
„ 22nd	e P	10 27 12	...	...	...	...	...	
	e L	10 30 30	...	...	...	...	...	
	M	10 32 00	...	...	70	...	...	
	F	11 13 42	...	...	...	...	...	
„ 25th	e P	5 39 12	...	...	...	...	...	Widening of line.
	F	6 44 12	...	...	...	...	...	

T. ROYDS,
Assistant Director.

BOMBAY OBSERVATORY.

4. During the month of February 1917 the traces showed 9 calm days, 17 days of small and 2 days of moderate disturbance.

The days of the month selected as "quiet" for the purposes of the Magnetic Survey of India are the 2nd, 9th, 13th, 22nd, and 24th.

The following table represents the magnetic character of each day during the month.

TABLE 3.

Day.	Character.	Day.	Character.	Day.	Character.	Day.	Character.
1	C	8	S	15	M	22	C
2	C	9	C	16	S	23	S
3	C	10	S	17	S	24	C
4	C	11	S	18	S	25	S
5	S	12	C	19	S	26	S
6	S	13	C	20	M	27	S
7	S	14	S	21	S	28	S

C = calm; S = small; M = moderate; G = great; V.G. = very great.

The mean observed absolute values of the several magnetic elements reduced to the mean monthly tabulations of the magnetograms, as also the ranges and the summed ranges of the horizontal force and declination for the month are as follows :—

Easterly declination . . .	0° 34′ 13″.
Horizontal force	0·36873 C. G. S. unit.
Vertical force	0·16847 C. G. S. unit.
Inclination	24° 33′.3.
Horizontal force range . . .	0·00045 C. G. S. unit.
Horizontal force summed range .	0·00297 C. G. S. unit.
Declination range . . .	2′·4.
Declination summed range . .	9′·4.

(NOTE.—Summed range means sum without regard to sign of twenty-four ordinates of the diurnal inequality.)

Seismic records.

$\phi = 18° 53′ 36″$; $\lambda = 72° 48′ 56″$; $h = 11$m. *Subsoil Trap.*

Apparatus.—Milne's Horizontal Pendulum Seismograph.

TABLE 4.

	V	To	6	$\frac{r}{To^2}$
AN:				
AE:	9	21	1	
AZ:				

Date.	Phase.	Time, G. M. T.	Period (Sec.)	Amplitude (u). An.	Ae.	Az.	Distance Δ (Km.).	Remarks.
1917.		h. m. s.						
Feb. 12th	...	12 16 m to 18 m	...	...	...	...	...	Thickening of line.
„ 14th	...	6 5	...	...	...	...	...	Do. do.
	...	6 9 m to 11 m	...	...	...	...	...	Do. do.
„ 15th	P	*1 8 8	...	...	...	...	...	P mixed in tremors.
	M	2 8 31	...	...	100	...	...	
	F	...	...	...	...	...	...	F mixed in tremors.
„ 20th	P	*19 49 46	...	...	...	...	...	P mixed in tremors.
	M	21 1 56	...	...	89	...	...	
	F	...	...	...	...	...	...	F mixed in tremors.
„ 21st	P	*10 1 11	...	...	...	...	...	P not well marked.
	M	11 1 29	...	...	56	...	...	
	F	11 13 48	...	...	...	...	...	
Feb. 22nd	P	9 47 55	...	...	...	...	...	P uncertain.
	M	10 31 49	...	...	67	...	...	
	F	10 47 11	...	...	...	...	...	
„ 25th	*P	*5 29 21	...	...	...	...	...	P not well marked.
	S	*5 36 42	...	...	...	...	...	
	M	5 52 47	...	...	33	...	...	
	F	...	...	...	...	...	...	F mixed in the beginning of the following disturbance.
„ 25th	P	*5 55 11	...	...	...	...	...	P mixed in the end of the preceding disturbance.
	S	*6 2 34	...	...	...	...	...	
	M	6 18 35	...	...	44	...	...	
	F	6 38 47	...	...	...	...	...	
„ 26th	...	10 10 m to 13 m	...	...	...	...	...	Thickening of line.

Sensibility to tilt 1·0 mm. of amplitude on the trace = 0·32″.

One disturbance at about 18d. 1½h. is masked by tremors.

*These values are as shown by the float record.

N. A. F. MOOS,
Director,
Bombay and Alibag Observatories.

5. CALCUTTA (ALIPORE) OBSERVATORY.

Seismic records.

$\phi = 22° 32′$ N ; $\lambda = 88° 20′$ E ; $h = 6.4$ m. *Subsoil* Alluvial.

Apparatus.—Two Omori-Ewing Horizontal Pendulum Seismographs.

TABLE 5.

	V	To	6	$\frac{r}{To^2}$
AN:	29	20	1	
AE:	29	45	1	
AZ:				

Date.	Phase.	Time, G. M. T.	Period (Sec.).	Amplitude (u). An.	Ae.	Az.	Distance △ (Km.).	Remarks.
1917.		h. m. s.						
Feb. 18th	P	1 30 18	...	...	...	...	...	Intensity very slight.
	S	1 35 54	8	...	...	...	...	
	F	2 7 42	...	...	...	...	...	

6.—SIMLA OBSERVATORY.

The following table contains a list of earthquakes that were reported:—

TABLE 6.

Place at which felt.	Date.	G. M. T. of earthquake.	Duration.	Intensity Rossi-Forel scale.	No. of shocks.
		h. m.	sec.		
Shillong	Feb. 11th	1 10	1	4	1
Ditto	„ 12th	12 36	1	4	1
Cherat	„ 17th	23 31	2	6	1
Shillong	„ 24th	15 45	1	5	1

Solar radiation.—Observations not recorded owing to absence of officers on war service.

The Simla seismograph notes will appear in a future number of this Review.

GILBERT T. WALKER,

Director-General of Observatories, Simla.

Weather in the Indian Ocean.

7. In the Equatorial belt as represented by Zanzibar and Seychelles barometric pressure was decidedly below normal, and rainfall was in marked excess at the former station and in slight defect at the latter. Further south at Mauritius pressure was normal and rainfall deficient.

TABLE 7.

——	Mauritius.	Zanzibar.	Seychelles.
Departure from normal of mean pressure	0	—·034	—·036
Actual mean wind direction . .	E	N 42° E	N 30° W
Normal mean wind direction . .	S 83° E	N 27° E	N 21° W
Actual mean wind velocity (miles per diem).	128	103	115
Normal mean wind velocity (miles per diem).	162	118	107
Rainfall departure from normal . .	—3·34	+1·88	—2·47

Depressions and cyclonic storms.

8. No regular cold weather storms entered India in the course of the month. A shallow depression appeared over Gujarat during the 1st and after developing *in situ* on the 2nd, began travelling north-eastwards on the 3rd. It was in the east of Central India and the adjoining districts of the United Provinces on the morning of the 4th and disappeared in the Almora hills during the 5th. Although only of slight intensity it was the cause of widespread and in places heavy rainfall in north-east India, the United Provinces and the central parts of the country. Another disturbance became visible over Gujarat on the 7th; this travelled eastwards and disappeared over Bengal during the 11th. It was not, however, very active and gave merely a few light falls of rain, chiefly in Assam, Upper Burma and the north of the Bombay Deccan. In addition to these two depressions a wave of low pressure was transmitted across northern India from the west between the 18th and the 26th causing light rain or snow, chiefly along the Himalayas.

At the close of the month a fairly well marked depression was entering north-west India from the west.

Pressure.

9. On the mean of the month barometric pressure was below the normal throughout the plains; the deficiency was least (about ·015″) in Burma and the north-east of the Peninsula, and was greatest (between ·04″ and ·07″) in north-west India, over most of which area there was an appreciable excess of temperature.

TABLE 8.

DIVISION.	Departure from normal of mean 8 hrs. pressure.
	"
Burma	—·014
Assam	—·028
Bengal	—·032
Bihar and Orissa	—·029
United Provinces	—·039
Punjab	—·051
North-West Frontier Province	—·070
Sind	—·060
Rajputana	—·043
Bombay	—·041
Central India	—·040
Central Provinces	—·025
Hyderabad	—·016
Mysore	—·023
Madras	—·026

The vertical gradients were weaker than usual in north-west India, and above their normal strength in the Central Provinces.

TABLE 9.

HILL STATION.	Departure from normal pressure. A	PLAIN STATION.	Departure from normal pressure. B	Departure of pressure difference. B—A.
	"		"	"
Quetta	—·017	Jacobabad	—·066	—·049
Leh	+·016	Lahore	—·057	—·073
Murree	+·007	Peshawar	—·070	—·077
Simla	+·007	Ludhiana	—·043	—·050
Darjiling	—·034	Dhubri	—·024	+·010
Mount Abu	—·024	Deesa	—·031	—·007
Pachmarhi	—·050	Khandwa	—·022	+·028
Kodaikanal	—·036	Madura	—·040	—·004

Temperature.

10. Mean maximum temperature of the month was distinctly above normal in north-east Baluchistan, the North-West Frontier Province, Kashmir, the Punjab and the greater part of Sind, and appreciably lower than usual in the interior districts of the Peninsula as well as in the extreme north of Burma. Minimum temperature did not differ to any great extent from the average, except in the hills of the extreme north where it was in general higher than usual. No marked hot or cool waves occurred during the month, but temperature was considerably above normal in north-west India from the 14th to the 22nd.

TABLE 10.

SUB-DIVISION.	ACTUAL TEMPERATURE. Mean maximum.	Mean minimum.	Monthly mean of mean between maximum and minimum.	Mean daily range of temperature.	DEPARTURE FROM NORMAL OF Maximum.	Minimum.	Daily range.
	°	°	°	°	°	°	°
1. Bay Islands	84·8	74·8	79·8	10·0	—1·3	—0·4	—0·9
2. Lower Burma	87·6	66·5	77·0	21·1	—0·8	—1·0	+0·2
3. Upper Burma	82·6	57·4	70·0	25·2	—3·0	+0·7	—3·7
4. Assam	75·1	55·1	65·1	20·0	—1·9	+1·8	—3·7
5. Bengal	79·9	59·3	69·6	20·6	—1·3	+1·6	—2·9
6. Orissa	82·8	63·3	73·1	19·4	—2·8	—0·1	—2·7
7. Chota Nagpur	80·5	55·8	68·1	24·7	—0·8	+0·6	—1·4
8. Bihar	77·9	54·8	66·4	23·1	—0·4	+1·0	—1·4
9. United Provinces, East	77·3	52·8	65·0	24·5	—0·8	+1·5	—2·3
10. Do. do., West	76·9	51·3	64·1	25·6	+0·3	+1·2	—0·9

Sub-division.	Actual temperature.				Departure from normal of		
	Mean maximm.	Mean minimum.	Monthly mean of mean between maximum and minimum.	Mean daily range of temperature.	Maximum.	Minimum.	Daily range.
	°	°	°	°	°	°	°
11. Punjab, East and North	76·2	47·0	61·6	29·2	+ 5·0	+ 0·5	+ 4·5
12. Do., South-west	78·5	47·1	62·8	31·5	+ 6·8	+ 2·0	+ 4·8
13. Kashmir	49·3	24·0	36·7	25·3	+ 7·4	+ 3·6	+ 3·8
14. North-West Frontier Province	75·1	44·7	59·8	30·4	+ 6·4	+ 1·3	+ 5·1
15. Baluchistan	67·2	38·1	52·6	29·1	+ 6·9	+ 0·9	+ 6·0
16. Sind	83·6	57·3	70·5	26·2	+ 4·7	+ 2·8	+ 1·9
17. Rajputana, West	82·7	53·6	68·1	29·1	+ 4·9	+ 0·9	+ 4·0
18. Do., East	80·7	52·4	66·5	28·3	+ 1·7	+ 0·4	+ 1·3
19. Gujarat	86·3	60·0	73·2	26·2	+ 1·0	+ 1·5	— 0·5
20. Central India, West	81·7	53·1	67·4	28·6	0	+ 1·3	— 1·3
21. Do., East	79·0	51·9	65·5	27·1	— 0·3	+ 0·5	— 0·8
22. Berar	85·3	60·4	72·9	25·0	— 3·4	+ 0·1	— 3·5
23. Central Provinces, West	81·5	55·1	68·3	26·3	— 2·9	0	— 2·9
24. Do., East	82·5	57·6	70·1	24·9	— 3·1	+ 0·2	— 3·3
25. Konkan	84·8	69·3	77·0	15·5	— 0·1	+ 0·9	— 1·0
26. Bombay Deccan	87·9	58·8	73·3	29·1	— 2·3	+ 0·2	— 2·5
27. Hyderabad, North	85·6	60·9	73·3	24·7	— 3·7	— 0·2	— 3·5
28. Hyderabad, South	87·1	64·5	75·8	22·6	— 4·1	— 1·0	— 3·1
29. Mysore	84·2	62·1	73·1	22·1	— 3·5	— 0·3	— 3·2
30. Malabar	87·8	73·2	80·5	14·6	— 0·3	+ 0·1	— 0·4
31. Madras, South-east	87·6	69·5	78·5	18·2	— 1·6	+ 0·2	— 1·8
32. Do. Deccan	89·5	66·3	77·9	23·2	— 4·9	— 0·4	— 4·5
33. Do. Coast, North	85·0	68·7	76·8	16·3	— 1·4	— 0·1	— 1·3

Table 11.

Division.	Departure from normal of		
	Mean maximum temperature.	Mean minimum temperature.	Mean temperature.
	°	°	°
Burma	— 1·7	— 0·3	— 1·0
Assam	— 1·9	+ 1·8	— 0·1
Bengal	— 1·3	+ 1·6	+ 0·2
Bihar and Orissa	— 1·3	+ 0·5	— 0·4
United Provinces	— 0·3	+ 1·4	+ 0·5
Punjab	+ 5·5	+ 0·9	+ 3·2
North-West Frontier Province	+ 6·4	+ 1·3	+ 3·9

Division.	Departure from normal of		
	Mean maximum temperature.	Mean minimum temperature.	Mean temperature.
	°	°	°
Sind	+ 4·7	+ 2·8	+ 3·8
Rajputana	+ 3·0	+ 0·6	+ 1·8
Bombay	— 0·5	+ 0·9	+ 0·2
Central India	— 0·1	+ 0·9	+ 0·4
Central Provinces	— 3·1	+ 0·1	— 1·5
Hyderabad	— 4·0	— 0·7	— 2·3
Mysore	— 3·5	— 0·3	— 1·9
Madras	— 1·8	0	— 0·9

Winds.

11. (*a*) The air movement was either about the average or below it except in Assam, the Punjab, Mysore and Madras, where it was appreciably stronger than usual.

(*b*) Winds were even more variable than usual in Bengal, the North-West Frontier Province and Sind, but were remarkably steady in Assam and Hyderabad.

(*c*) The direction of air movement was very unusual in lower Bengal, the east of Central India and the west of the United Provinces.

TABLE 12.

STATION.	MEAN WIND DIRECTION.	
	Actual.	Normal.
Agra	S 49° W	N 53° W
Lucknow	S 51° W	N 74° W
Nowgong	S 20° W	N 85° W
Sutna	S 27° W	N 30° W
Berhampore	S 17° E	S 83° W
Jessore	S	N 18° W
Naraingani	S 21° W	N 27° W

TABLE 13.

DIVISION.	DEPARTURE FROM NORMAL ON	
	Hourly wind velocity.	Wind steadiness.
Burma	0	— 2
Assam	+0·4	+33
Bengal	—0·1	— 4
Bihar and Orissa	0	— 2
United Provinces	—0·3	+ 3
Punjab	+0·3	+ 8
North-West Frontier Province	—0·9	—22
Sind	—1·1	— 8
Rajputana	—0·2	+ 4
Bombay	—0·6	— 1
Central India	—0·3	+ 4
Central Provinces	+0·2	+ 3
Hyderabad	—0·5	+23
Mysore	+0·6	— 3
Madras	+0·6	+ 4

Humidity and cloud.

12. Aqueous vapour and relative humidity were both appreciably in excess in Sind, east Gujarat, the Central Provinces and Central India, and the latter alone in Orissa, Hyderabad and Mysore, while in the North-West Frontier Province, the Punjab and north Rajputana the air was drier than usual in both respects. Elsewhere the hygrometric conditions were fairly normal.

Skies were unusually clear over north-west India and the Andamans, and covered to much more than the customary extent in Burma excluding Tenasserim, Assam, Bengal and the greater part of the Peninsula.

TABLE 14.

DIVISION.	HYGROMETRY; 8 HRS.				CLOUD.	
	Mean humidity.	Departure from normal.	Mean vapour tension in inches of mercury.	Departure from normal in inches of mercury.	Mean cloud amount at 8 hrs.	Departure from normal.
	%					
Burma	81	0	·555	—·020	3·6	+1·4
Assam	89	0	·457	+·015	5·2	+1·7
Bengal	83	+ 3	·512	+·028	3·7	+1·6
Bihar and Orissa	78	+ 6	·451	+·029	2·8	+0·5
United Provinces	72	+ 2	·348	+·019	2·1	—0·4
Punjab	64	— 9	·257	—·020	2·1	—1·4
North-West Frontier Province.	64	— 7	·225	—·019	2·7	—1·1
Sind	67	+ 7	·382	+·066	0·6	—2·0
Rajputana	47	— 4	·239	—·006	1·0	—1·7
Bombay	64	+ 5	·451	+·039	1·5	+0·2
Central India	62	+ 7	·324	+·037	1·9	—0·3
Central Provinces	62	+10	·372	+·057	2·0	+0·1
Hyderabad	62	+ 8	·455	+·010	2·3	+0·8
Mysore	73	+ 7	·499	+·018	3·6	+1·3
Madras	79	+ 2	·684	+·006	3·2	+0·6

Rainfall.

13. Owing to the unusual character of the disturbances rainfall was abnormally distributed. It was deficient in the Bay Islands, Lower Burma, the Punjab, Kashmir, the North West Frontier Province, Baluchistan, Sind and Rajputana West, and was above the normal in almost all other parts of the country. The excess ranged between 2″ and 3″ in Assam, Orissa, the Central Provinces East, Hyderabad North and the Madras Deccan, and between 1″ and 2″ in Berar, the Central Provinces West, Hyderabad South, Mysore and Malabar; while the deficiency was most emphatic in Kashmir (2½″ or 78 per cent.), the North-West Frontier Province (1⅓″ or 97 per cent.) and Baluchistan (1⅔″ or 97 per cent.)

TABLE 15.

SUB-DIVISION.	NUMBER OF RAINY DAYS.		RAINFALL.			
	Actual.	Normal.	Actual.	Normal.	Departure from normal.	Percentage departure from normal.
			″	″	″	
1. Bay Islands	0	0·9	0·07	0·59	—0·52	— 88
2. Lower Burma	0·3	0·4	0·11	0·28	—0·17	— 61
3. Upper Burma	1·7	0·4	0·57	0·16	+0·41	+256
4. Assam	8·2	3·1	3·81	1·28	+2·53	+198
5. Bengal	2·4	1·6	1·22	0·92	+0·30	+ 33
6. Orissa	4·7	1·4	3·85	0·92	+2·93	+318
7. Chota Nagpur	2·5	2·5	1·70	1·38	+0·32	+ 23
8. Bihar	1·5	1·6	0·75	0·73	+0·02	+ 3
9. United Provinces, East	1·9	1·3	1·05	0·53	+0·52	+ 98
10. Do., West	2·1	1·6	1·17	0·89	+0·28	+ 31
11. Punjab, East and North	0·5	2·1	0·13	1·07	—0·94	— 88
12. Punjab, South-west	0	1·4	0	0·57	—0·57	—100
13. Kashmir	1·6	4·9	0·72	3·33	—2·61	— 78
14. North-West Frontier Province	0·2	3·0	0·04	1·38	—1·34	— 97
15. Baluchistan	0·2	3·3	0·05	1·45	—1·40	— 97
16. Sind	0	0·9	0·02	0·32	—0·30	— 94
17. Rajputana, West	0·2	0·7	0·05	0·34	—0·29	— 85
18. Do., East	1·3	0·8	0·37	0·33	+0·04	+ 12
19. Gujarat	0·5	0·3	0·20	0·12	08	+ 67
20. Central India, West	1·7	0·7	0·84	0·29	+0·55	+190
21. Do., East	1·6	1·3	0·78	0·65	+0·13	+ 20
22. Berar	3·0	0·6	2·12	0·30	+1·82	+607
23. Central Provinces, West	3·3	1·1	2·13	0·57	+1·56	+274
24. Do., East	3·7	1·3	3·30	0·77	+2·53	+329
25. Konkan	1·3	0·1	0·76	0·03	+0·73	+2433
26. Bombay Deccan	1·6	0·2	0·70	0·08	+0·62	+775
27. Hyderabad, North	2·7	0·4	2·48	0·19	+2·29	+1205
28. Do., South	1·8	0·5	1·30	0·21	+1·09	+519

Sub-division.	Number of rainy days.		Rainfall.			
	Actual.	Normal.	Actual.	Normal.	Departure from normal.	Percentage departure from normal.
			"	"	"	
29. Mysore	2·4	0·2	1·44	0·11	+1·33	+1209
30. Malabar	2·1	0·4	1·94	0·19	+1·75	+921
31. Madras, South-east	2·1	0·8	1·35	0·52	+0·83	+160
32. Do.. Deccan	2·8	0	2·27	0·09	+2·18	+2422
33. Do. Coast, North	2·1	0·5	1·16	0·38	+0·78	+205

TABLE 16.

Division.	Rainfall.			
	Actual.	Normal.	Departure from normal.	Percentage departure from normal.
	"	"	"	
Burma	0·39	0·20	+0·19	+ 95
Assam	3·81	1·28	+2·53	+198
Bengal	1·22	0·92	+0·30	+ 33
Bihar and Orissa	1·74	0·93	+0·81	+ 87
United Provinces	1·12	0·73	+0·39	+ 53
Punjab	0·10	0·95	—0·85	— 89
North-West Frontier Province	0·04	1·38	—1·34	— 97

Division.	Rainfall.			
	Actual.	Normal.	Departure from normal.	Percentage departure from normal.
	"	"	"	
Sind	0·02	0·32	—0·30	— 94
Rajputana	0·25	0·33	—0·08	— 24
Bombay	0·55	0·08	+0·47	+587
Central India	0·81	0·47	+0·34	+ 72
Central Provinces	2·58	0·57	+2·01	+353
Hyderabad	1·89	0·20	+1·69	+845
Mysore	1·44	0·11	+1·33	+1209
Madras	1·45	0·40	+1·05	+263
Mean of India	1·11	0·53	+0·58	+109

Snowfall.

I.—AFGHANISTAN.

14. A slight fall of snow is reported to have occurred on the Hindu Kush.

II.—NORTH-WEST FRONTIER PROVINCE.

(*a*) *Wano.*—No snow fell on the mountains in the Wano Agency.

(*b*) *Kohat.*—There was no snowfall on the Samana range.

III.—KASHMIR.

(*a*) *Srinagar.*—Slight rain and snow fell on three days during the last week.

(*b*) *Skardu.*—There were very slight falls on the highest peaks of the surrounding hills on the 16th, 21st and 23rd.

(*c*) *Dras.*—Snow fell on nine days to a total depth of about one foot.

(*d*) *Kargil.*—There were altogether five falls on the surrounding mountains and three of these descended to the level of the station. The total quantity received during the month was estimated at 1 foot on the Archulla, 10½" on the Samenulla, 9" on the Nakthulla, 5½" on the Narianulla and about 4" on the Pazgolla.

The statement below shows the estimated depth of the unmelted residue of the accumulations on the last day of the month:—

TABLE 17.

Archulla	2 feet.
Samenulla	2 ,,
Nakthulla	1 foot.
Narianulla	4 to 5 inches.
Pazgolla	4 to 5 ,,
Barulla	4 to 5 ,,

IV.—PUNJAB.

Kilba (*Simla Hills*).—Snow fell on seven days as follows:—

TABLE 18.

3rd	down to	8,000	feet	where	the	depth	was 1 inch.
4th	,, ,,	5,750	,,	,,	,,	,,	3 ,,
5th	,, ,,	7,000	,,	,,	,,	,,	2 ,,
9th	,, ,,	8,000	,,	,,	,,	,,	2 ,,
10th	,, ,,	7,000	,,	,,	,,	,,	2 ,,
21st	,, ,,	7,000	,,	,,	,,	,,	2 ,,
22nd	,, ,,	7,000	,,	,,	,,	,,	3 ,,

All the passes were closed, and on the 28th the depths of accumulation were :—

TABLE 19.

Name of pass.	Reported.	Normal.
Shatul	8 feet.	123 feet.
Brua	8 „	13½ „
Rupin	7 „	13 „
Harang	3 „	8 „

V.—UNITED PROVINCES.

(*a*) *Garhwal.*—Snow to a depth of about 2′ is reported to have fallen on the higher peaks in the north of the district.

(*b*) *Almora.*—The total fall of the month was estimated at about 4′ in Byans and Chaudas, and 7½′ in Malla Darma.

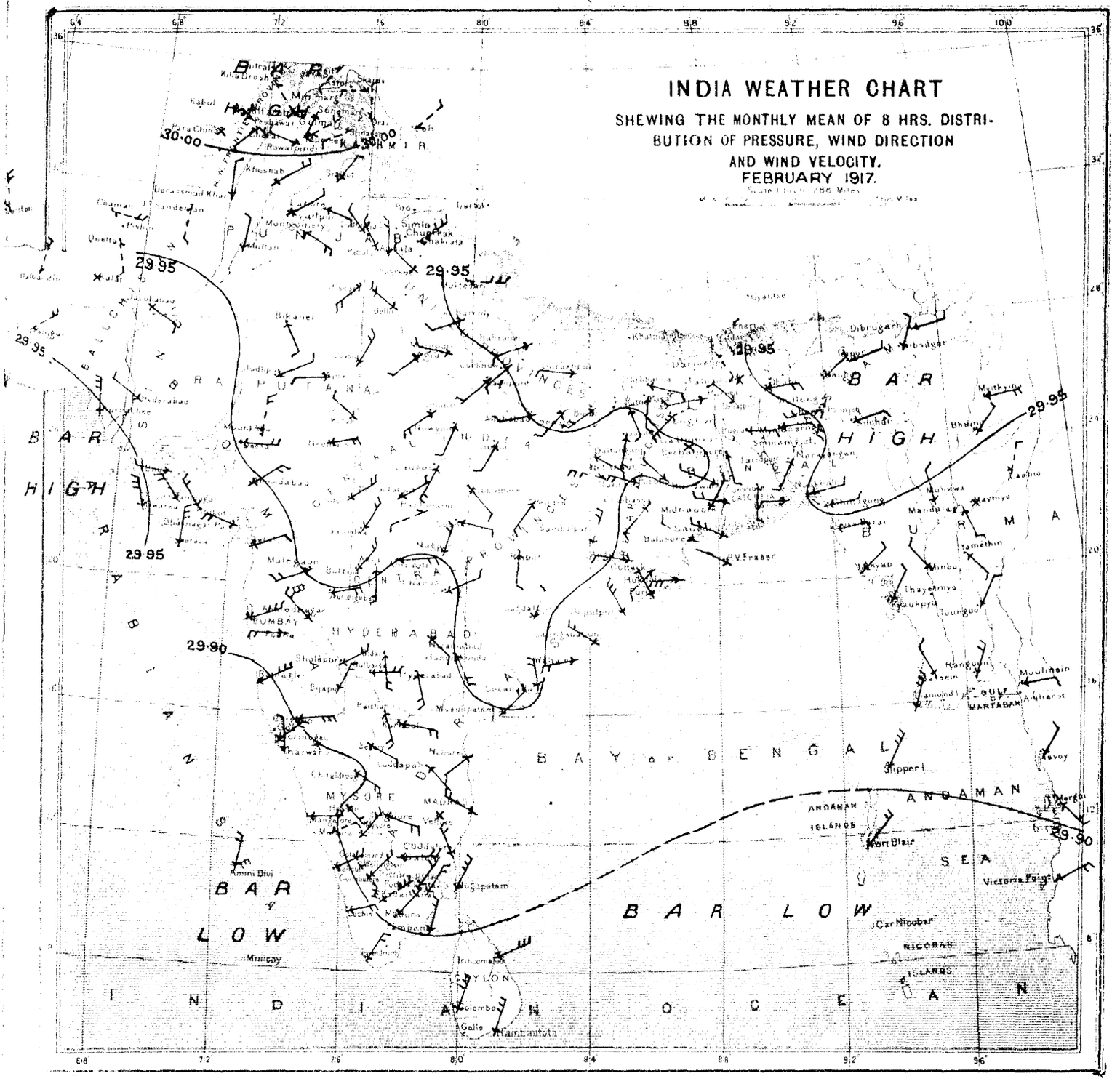
TABLE 20.

Name of pass or peak.	Depth of accumulation at the end of the month.	
	Reported.	Normal.
Nuwe Pass	14 feet.	37 feet.
Lampia „	9 „	21½ „
Binkaru „	9 „	24 „
Lipulekh „	8 „	19 „

SUMMARY.

15. The snowfall of the month in the mountain zone bordering upper India was much below the normal.

HEMRAJ.

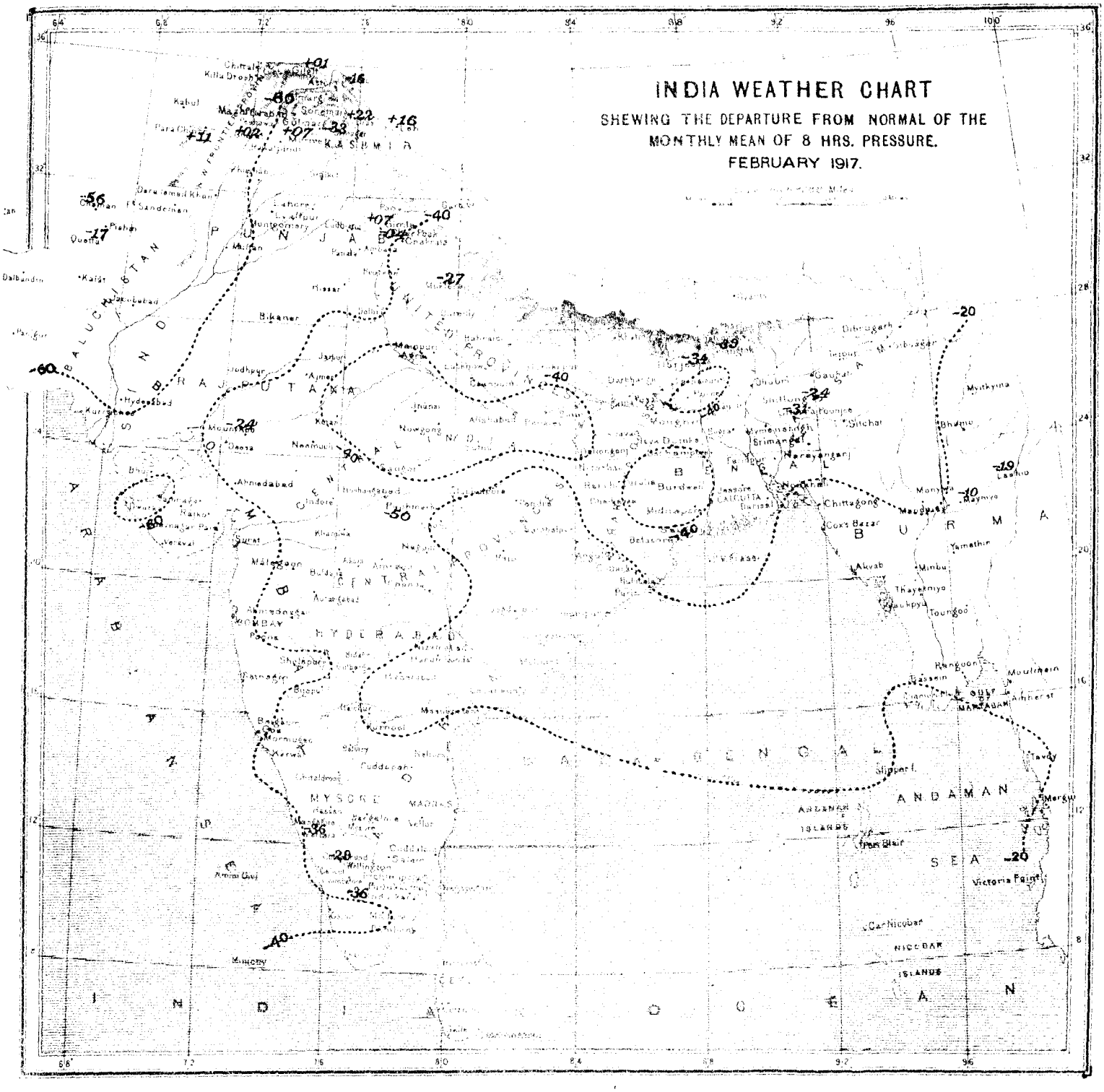


The lines of the above chart represent isobars or lines of equal barometric pressure, the numbers attached indicating the barometric pressure in inches and being drawn for differences of pressure of ·05 inch. The isobars in the Bay of Bengal are filled in by means of the shore observations, and by comparison with the normal distribution of pressure.

The mean 8 hrs. wind directions of the month are shewn by means of arrows flying with the wind, and are calculated by means of Lambert's formula applied to the winds as given in Table B of the 8 hrs. observations. The mean wind directions for the hill stations are indicated by broken arrows to distinguish them from the wind arrows for the plain stations. The mean velocity of the winds during the month is shewn by the following notation:—

Velocity of	0 to 2 miles per hour	...	one feather added to the wind arrow.
,,	,, 2 to 5 ,, ,, ,,	...	two feathers ,, ,, ,, ,,
,,	,, 5 to 10 ,, ,, ,,	...	three ,, ,, ,, ,, ,,
,,	,, 10 to 20 ,, ,, ,,	...	four ,, ,, ,, ,, ,,
	over 20 ,, ,, ,,	...	five ,, ,, ,, ,, ,,

Wind strengths are based on factor 2·2 for the standard type of Beckley Robinson anemograph, instead of 3·0 as used for this plate up to December 1911 inclusive.



The chart shows the departure from normal of the mean during the month of 8 hrs. pressure by means of lines drawn for equal amounts of departure. The numbers are given in thousandths of an inch, 20 representing '020' or two hundredths of an inch, &c. Continuous lines indicate that the pressure was in excess by amounts indicated by the numbers attached to the lines, and broken or dotted lines that it was in defect by amounts indicated by the numbers attached to the lines. Two parallel lines near to each other, one continuous and the other broken or dotted, represent the line of no departure, the dotted line facing the area of deficient pressure or negative departures.

CHART SHEWING THE DEPARTURE FROM NORMAL
OF THE MONTHLY MEAN OF DAILY
MAXIMUM TEMPERATURE.

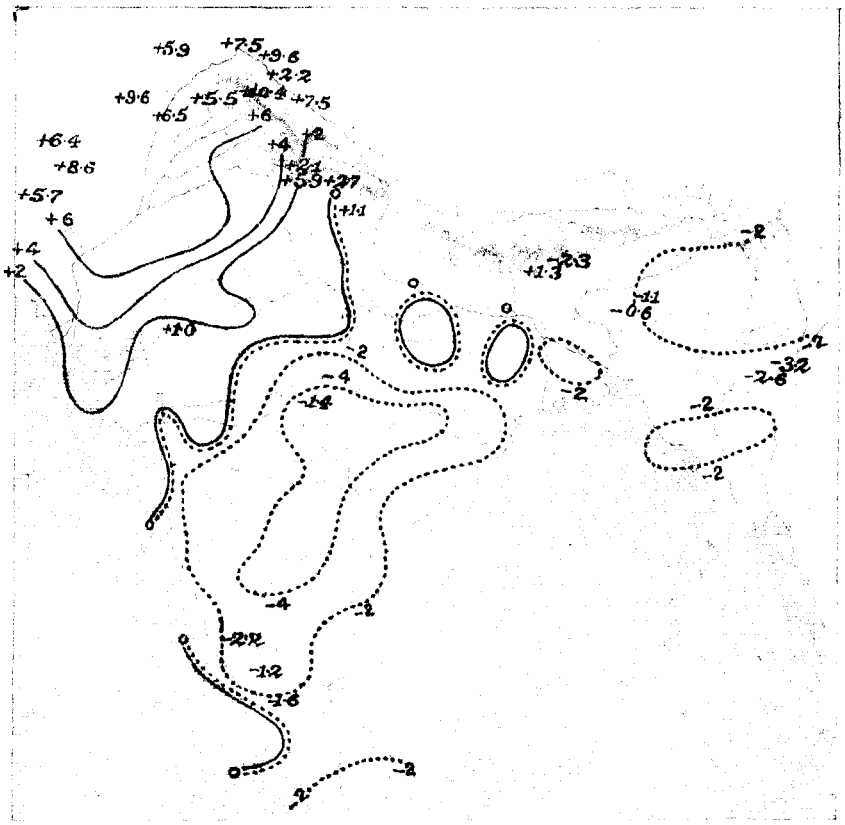


CHART SHEWING THE DEPARTURE FROM NORMAL
OF THE MONTHLY MEAN OF DAILY
MINIMUM TEMPERATURE.

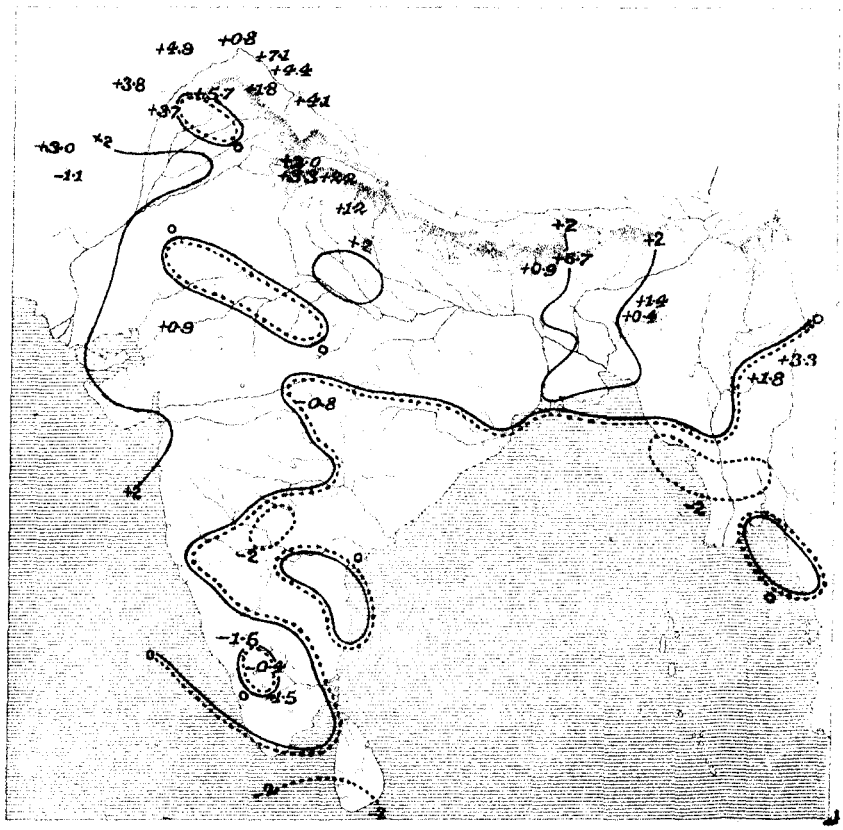


CHART SHEWING THE DEPARTURE FROM NORMAL
OF THE MONTHLY MEAN OF DAILY
MEAN TEMPERATURE.

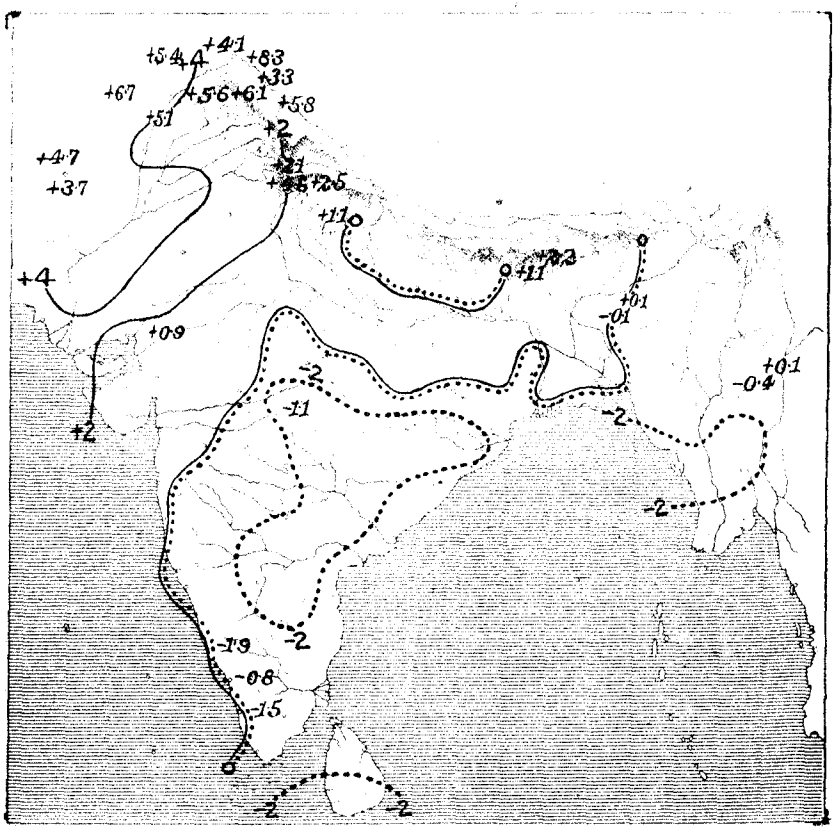


CHART SHEWING THE DEPARTURE FROM NORMAL OF THE MONTHLY MEAN OF ABSOLUTE HUMIDITY AT 8 HRS.

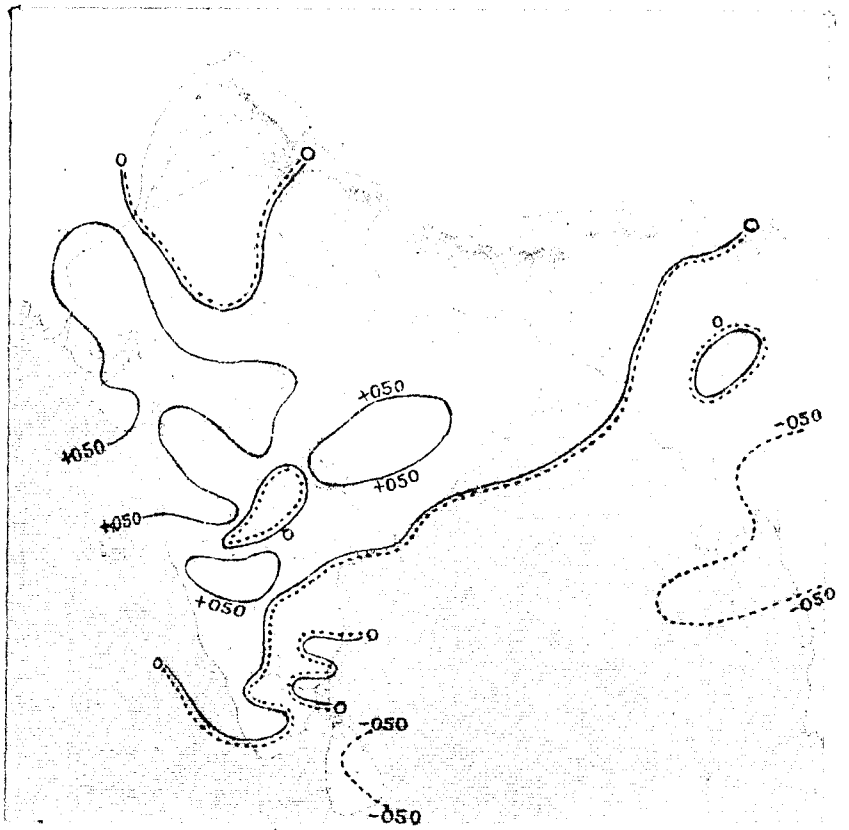


CHART SHEWING THE DEPARTURE FROM NORMAL OF THE MONTHLY MEAN OF RELATIVE HUMIDITY AT 8 HRS.

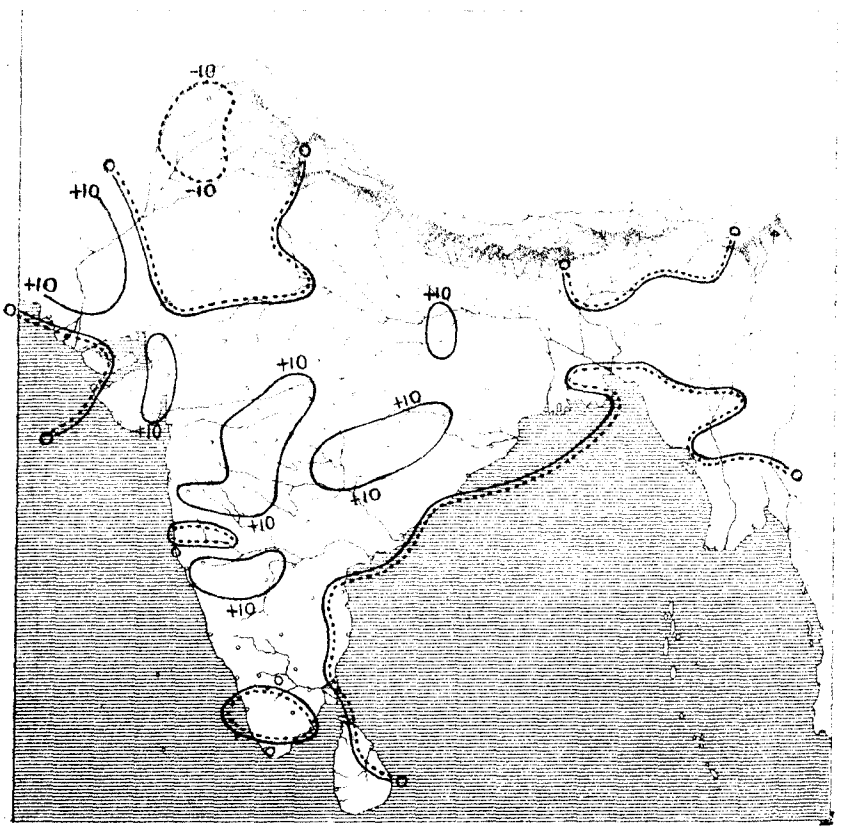


CHART SHEWING THE DEPARTURE FROM NORMAL
OF THE MONTHLY MEAN OF CLOUD
AMOUNT AT 8 HRS.

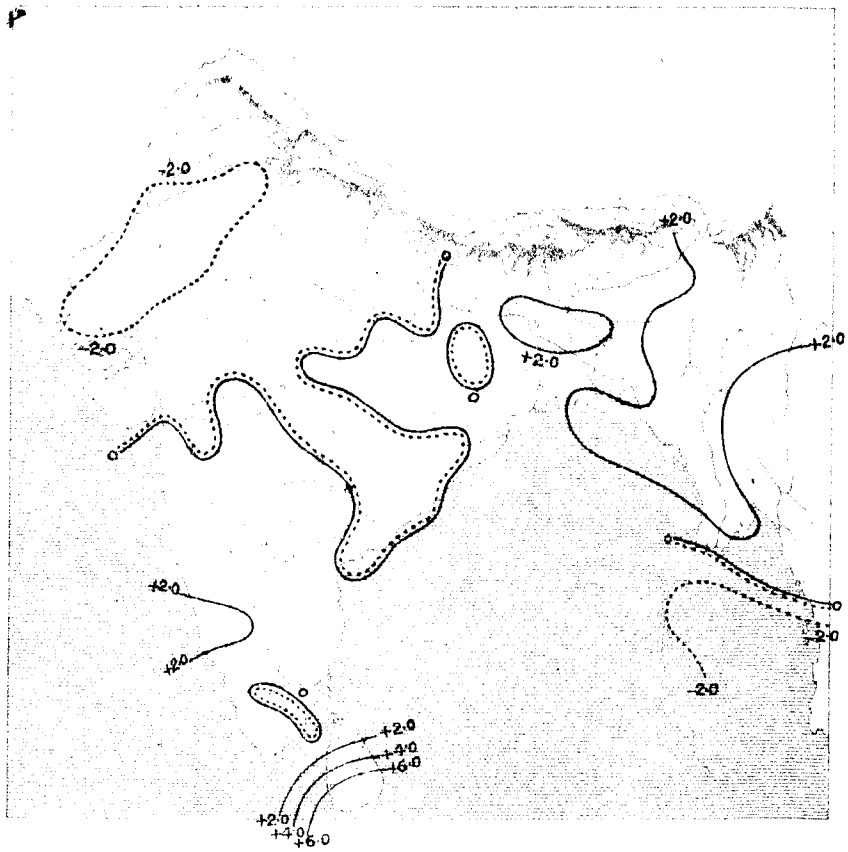
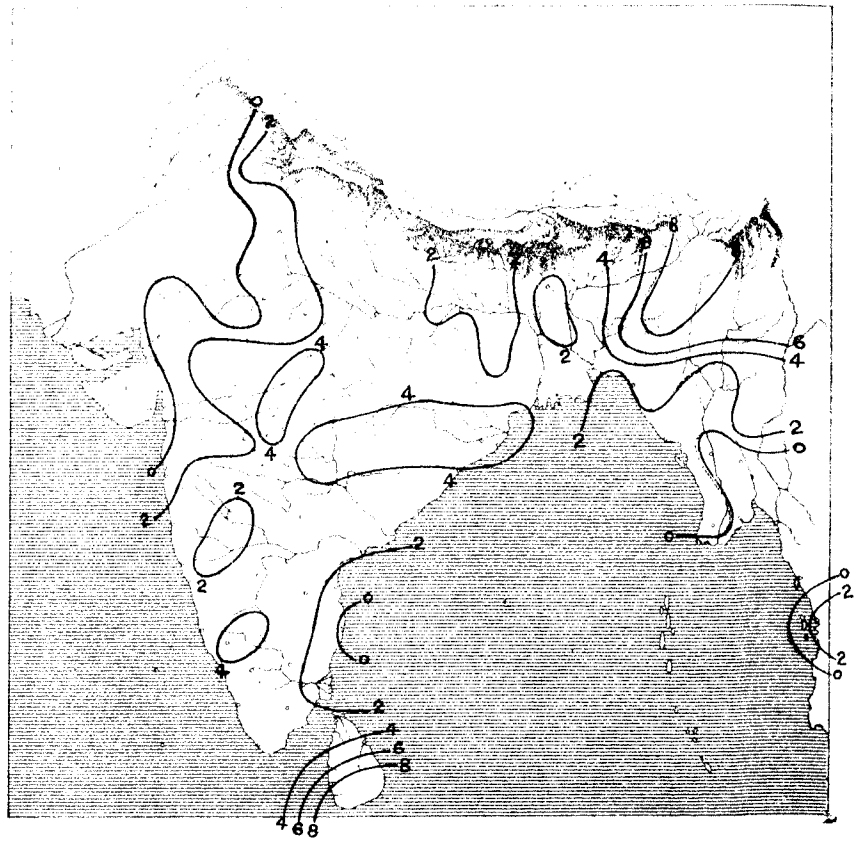
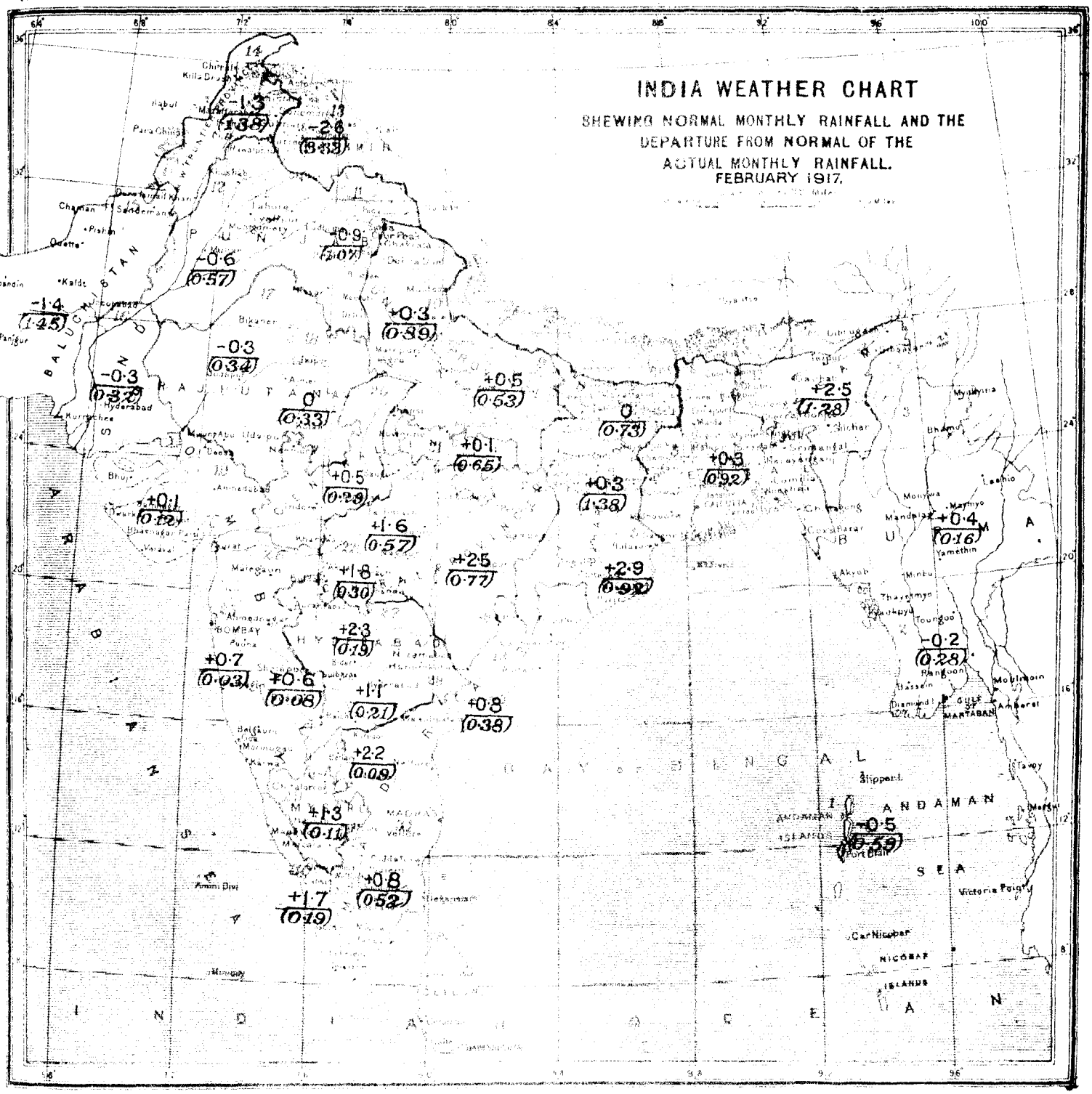


CHART SHEWING THE TOTAL NUMBER OF DAYS IN THE
MONTH ON WHICH RAINFALL EQUALLED OR
EXCEEDED 0·10 INCH.
(BASED ON THE RETURNS OF TABLE B.)





The country is divided into 33 areas as shewn in the list below. The numbers in that list correspond with the red numbers on the chart, and serve to identify the areas. The numbers in brackets on the chart give the average over the divisions of the normal monthly rainfall, the numbers above these give the departures from normal of the average actual rainfall over the divisions.

1. Bay Islands
2. Lower Burma
3. Upper Burma
4. Assam
5. Bengal
6. Orissa
7. Chota Nagpur
8. Bihar
9. United Provinces, East
10. United Provinces, West
11. Punjab, East and North
12. Do., Southwest
13. Kashmir
14. Northwest Frontier Province
15. Baluchistan
16. Sind
17. Rajputana, West
18. Rajputana, East
19. Gujarat
20. Central India, West
21. Do., East
22. Berar
23. Central Provinces, West
24. Do., East
25. Konkan
26. Bombay, Deccan
27. Hyderabad, North
28. Hyderabad, South
29. Mysore
30. Malabar
31. Madras, Southeast
32. Madras, Deccan
33. Madras Coast, North

GOVERNMENT OF INDIA.

METEOROLOGICAL DEPARTMENT.

MONTHLY WEATHER REVIEW

PUBLISHED BY ORDER OF

THE GOVERNMENT OF INDIA.

CALCUTTA, MARCH, 1917.

INTRODUCTION.

THIS review of the weather in India during the month of March, 1917, is based on observations taken daily at 8 hrs. at 214 stations, and on additional observations taken at 10 hrs. and 16 hrs. at 11 stations. In the rainfall summary have been utilized the data furnished by the meteorological observatories, and the rainfall statements of the month published by the Provincial Governments.

The brief notes on solar, seismic and magnetic disturbances are supplied by the chief observatories in the Indian area.

For a statement of the methods adopted in recording and tabulating the data, for each of the elements of observation, reference should be made to the introductory portion of the review for January.

Summary of the chief features of the weather in India during the month.

2. Several disturbances of the cold weather type appeared, but the precipitation associated with them occurred chiefly along the North-West Frontier, so that over nearly the whole tract stretching eastwards from the Indus to Upper Burma weather was unusually dry. In most of the Peninsula, including the Central Provinces as well as in Lower Burma and Central India East, on the other hand, thunderstorms were more frequent than usual and the month's rainfall was largely above normal.

Of climatic elements other than rainfall the quantity of cloud was decidedly low in Assam, Bengal, Sind and Kashmir, and high in Burma, Hyderabad, Mysore and Madras. Humidity was largely in defect in the Punjab and markedly in excess in Sind. Temperature was within 2° of the normal except in the Central Provinces and Hyderabad, where it was 3° lower than usual.

Barometric pressure in the plains of India as a whole was in defect by ·007".

Solar, magnetic and seismic disturbances.

KODAIKANAL OBSERVATORY.

3. *Solar Observations.*—No solar observations were possible on one day in the month and on four other days the prominence record was imperfect.

Sunspots.—Twenty-four new groups of spots were recorded in the month—three of them containing fairly large spots. The daily average number was 5·6 and the average life of a spot was 6·5 days. The distribution of the spots in latitude was as follows :—

TABLE 1.

—	0°—10°	11°—20°	21°—30°	31°—40°	Mean latitude.	Extreme latitudes.
North .	4	9	2	1	15°·0	6°, 33°
South .	1	6	1	...	16°·9	10°, 30°

The appearance of spots at 33° and 30° is an exceptional circumstance for this part of the cycle. They were, however, very small ones and the former group was seen on only one day.

Disturbances in C and D_3 were frequently recorded near spots.

Prominences.—There was exceptional activity during the month. One hundred and twenty-three large (60″ or more in height), nine metallic, and six eruptive prominences were recorded. The tallest of them was a slanting cone photographed in the north-east quadrant on the 8th. The base gradually rose till in about 2 hours it was 120″ from the limb. The total height of the prominence was 450″. On the 19th there were three prominences, in three different quadrants, which were respectively 180″, 245″, and 215″ in height.

Magnetic disturbances.—'Moderate' magnetic disturbances were recorded from the 4th to the 6th, on the 20th, 21st, 23rd and 25th.

J. EVERSHED,
Director,
Kodaikanal and Madras Observatories.

Seismic records.

$\phi = 10° 13' 50''$; $= \lambda 77° 28' 00''$; $h = 2{,}343$ m. Subsoil Rock.

Apparatus.—Milne's Horizontal Pendulum Seismograph.

TABLE 2.

	V	To	ϵ	$\frac{r}{To^2}$
AN:				
AE:	9·76	17·0	1	2·6
AZ:				

Date.	Phase.	Time G. M. T.	Period (Sec.).	Amplitude (u). An.	Ae.	Az.	Distance △ (Km.).	Remarks.
		h. m. s.						
1917. March 14th	e P	1 15 18	...	...	...	...	...	Widening of line.
	F	1 25 24	...	...	...	...	...	
„ 15th	e P	0 34 06	...	...	...	...	...	
	e L	0 54 12	...	...	...	...	...	
	M	1 01 00	...	...	70	...	...	
	F	2 01 30	...	...	...	...	...	
„ 16th	e P	3 30 18	...	...	...	...	...	Widening of line.
	F	4 04 30	...	...	...	...	...	

J. EVERSHED,
Director.

BOMBAY OBSERVATORY.

Alibag magnetic record.

4. During the month of March 1917 the traces showed 11 calm days, and 20 days of small disturbance.

The days of the month selected as "quiet" for the purposes of the Magnetic Survey of India are the 2nd, 11th, 18th, 19th and 29th.

The following table represents the magnetic character of each day during the month:—

TABLE 3.

Day.	Character.	Day.	Character.	Day.	Character.	Day.	Character.
1	S	9	S	17	S	25	S
2	C	10	S	18	C	26	C
3	S	11	C	19	C	27	S
4	S	12	C	20	S	28	C
5	S	13	S	21	S	29	C
6	S	14	S	22	S	30	C
7	C	15	S	23	S	31	S
8	S	16	S	24	C	...	...

C=calm; S=small; M=moderate; G=great; V. G.=very great.

The mean observed absolute values of the several magnetic elements reduced to the mean monthly tabulations of the magnetograms as also the ranges and the summed ranges of the horizontal force and declination for the month are as follows:—

Easterly declination	0° 34′ 19″.
Horizontal force	0·36881 C.G.S. unit.
Vertical force	0·16852 C.G.S. „
Inclination	24° 33′·4.
Horizontal force range	0·00065 C.G.S. unit.
„ „ summed range	0·00406 C.G.S. „
Declination range	3′·6.
„ summed range	12′·4.

(NOTE.—Summed range means sum without regard to sign of the twenty-four ordinates of the diurnal inequality.)

Seismic records.

$\phi = 18° 53' 36''$; $\lambda = 72° 48' 56''$; $h = 11$ m. Subsoil Trap.

Apparatus.—Milne's Horizontal Pendulum Seismograph.

TABLE 4.

	V	To	ϵ	$\frac{r}{To^2}$
AN:				
AE:	9	21	1	
AZ:				

Date.	Phase.	Time G. M. T.	Period (Sec.).	Amplitude (u). An.	Ae.	Az.	Distance △ (Km.).	Remarks.
1917.		h. m. s.						
Mar. 1st	...	5 59 to 62	...	...	..	...	...	Thickening of line.
„ 6th	P	.....	...	...	...	...	...	Beginning doubtful.
	M	4 34 28	...	...	22	...	...	
	F	4 42 18	...	...	...	...	...	
„ 15th	P	*0 24 44	...	...	...	...	...	
	M	0 55 5	...	...	100	...	...	
	F	.....	...	...	...	...	...	End mixed in tremors.
„ 21st	...	3 54 0	...	...	...	...	...	Thickening of line.
„ 24th	...	14 4 0	...	...	...	...	...	Do.
„ 31st	...	17 39 0	...	...	...	...	...	Do.

Sensibility to tilt 1·0 mm. of amplitude on the trace = 0·32″.

* This value is as shown by the float record.

N. A. F. Moos,

Director,

Bombay and Alibag Observatories.

5.—CALCUTTA (ALIPORE) OBSERVATORY.

Seismic records.

ϕ 22° 32′ N ; λ = 88° 20′ E; h = 6·4 m. Subsoil Trap.

Apparatus.—Two Omori-Ewing Horizontal Pendulum Seismographs.

TABLE 5.

	V	To	ϵ	$\frac{r}{To^2}$
AN:	29	20	1	
AE:	29	45	1	
AZ:				

Date.	Phase.	Time G. M. T.	Period (Sec.).	Amplitude (u). An.	Ae.	Az.	Distance △ (Km.)	Remarks.
1917.		h. m. s.						
March 15th	P	0 23 12	5·5	...	...	...	...	
	S	0 30 30	7·5	...	...	...	...	
	L	0 43 12	12·0	...	...	...	...	
	M	0 50 6	12·0	86	69	...	...	
	F	1 19 42	...	...	...	...	...	

6.—SIMLA OBSERVATORY.

The following table contains a list of earthquakes that were reported :—

TABLE 6.

Place at which felt.	Date.	G. M. T. of earthquake.	Duration.	Intensity Rossi-Forel scale.	Number of shocks.	Remarks.
		h. m.	sec.			
Junagadh (Kathiawar).	Mar. 29th	12 15	6	3	1	
Hoti (District Peshawar.)	„ 31st	12 00	60	5	1	

Solar radiation.—Observations not recorded owing to the absence of officers on war service.

The Simla Seismograph notes will appear in a future number of this Review.

G. C. SIMPSON,

Offg. *Director-General of Observatories, Simla.*

Weather in the Indian Ocean.

7. In the west of the equatorial belt as represented by Zanzibar and Seychelles the barometer stood below its normal height, winds were abnormal in direction and weather was unusually dry.

TABLE 7.

	Mauritius.	Zanzibar.	Seychelles.
Departure from normal of mean pressure	Data not received.	—·026	—·019
Actual mean wind direction		N 23° E	N 43° W
Normal mean wind direction		S 27° E	N 17° W
Actual mean wind velocity (miles per diem).		91	108
Normal mean wind velocity (miles per diem).		94	86
Rainfall departure from normal		—1·55	—8·13

Depressions and cyclonic storms.

8. In northern India the disturbances of the cold weather type which constitute the chief feature of the weather of the period December to February are in March of comparatively rare occurrence and their paths occupy a more northerly position. During the month under review no less than eight such disturbances occurred, and of these half the number advanced along more southerly tracks than usual. With the exception of two all the disturbances were feeble barometrically; all of them were, however, attended with precipitation in north-west India, chiefly in the hills, and in the case of the first two disturbances of the month there was rain also in Bengal and Assam.

Pressure.

9. Atmospheric pressure in the plains was on the mean of the month ·007″ lower than usual. The defect was not, however, entirely general, for over a large part of north-east India and of the United Provinces pressure tended to be high.

TABLE 8.

DIVISION.	Departure from normal of mean 8 hrs. pressure.
	″
Burma	—·022
Assam	+·008
Bengal	0
Bihar and Orissa	+·007
United Provinces	+·010
Punjab	—·002
North-West Frontier Province	—·023
Sind	—·008
Rajputana	—·011
Bombay	—·018
Central India	—·009
Central Provinces	—·005
Hyderabad	0
Mysore	—·015
Madras	—·015

The vertical gradient was on the whole of about normal strength.

TABLE 9.

HILL STATION.	Departure from normal pressure—A.	PLAIN STATION.	Departure from normal pressure—B.	Departure of pressure difference B—A.
	″		″	″
Quetta	—·019	Jacobabad	—·009	+·010
Leh	—·022	Lahore	—·007	+·015
Murree	—·015	Peshawar	—·015	0
Simla	+·013	Ludhiana	+·006	—·007
Darjiling	—·006	Dhubri	+·010	+·016
Mount Abu	—·015	Deesa	—·009	+·006
Pachmarhi	—·031	Khandwa	—·008	+·023
Kodaikanal	—·035	Madura	—·028	+·007

Temperature.

10. Temperature conditions approximated closely to the normal except in the Madras Deccan, Hyderabad and the Central Provinces proper, where maximum temperature was lower than usual by 3° or more.

TABLE 10.

SUB-DIVISION.	ACTUAL TEMPERATURE.				DEPARTURE FROM NORMAL OF		
	Mean maximum.	Mean minimum.	Monthly mean of mean between maximum and minimum.	Mean daily range of temperature.	Maximum.	Minimum.	Daily range.
	°	°	°	°	°	°	°
1. Bay Islands	86·5	76·7	81·7	9·7	—2·3	+0·4	—2·7
2. Lower Burma	90·9	71·5	81·2	19·4	—0·8	+0·3	—1·1
3. Upper Burma	92·1	64·5	78·3	27·7	—0·4	+0·7	—1·1
4. Assam	83·0	60·0	71·4	23·0	—0·6	—0·4	—0·2
5. Bengal	88·1	65·0	76·6	23·1	—1·3	—1·7	+0·4
6. Orissa	90·8	67·8	79·3	23·0	—2·1	—2·5	+0·4
7. Chota Nagpur	90·1	62·8	76·5	27·3	—0·8	—0·5	—0·3
8. Bihar	88·7	61·7	75·2	26·9	—1·5	—1·7	+0·2
9. United Provinces, East	88·3	59·5	73·9	28·8	—2·3	—1·3	—1·0
10. Do. do., West	87·2	58·3	72·8	28·9	—1·7	—1·1	—0·6
11. Punjab, East and North	83·4	55·2	69·3	28·3	+0·2	—0·9	+1·1
12. Do., South-west	83·8	54·8	69·3	29·0	+0·6	—1·0	+1·6
13. Kashmir	53·8	31·3	42·5	22·5	+1·4	—0·2	+1·6
14. North-West Frontier Province	77·9	52·1	65·0	25·9	—0·7	—1·3	+0·6
15. Baluchistan	69·0	42·0	55·5	27·0	—0·5	—1·9	+1·4
16. Sind	87·4	62·8	75·1	24·5	—1·0	—0·5	—0·5
17. Rajputana, West	90·0	61·6	75·8	28·4	+0·1	—1·7	+1·8
18. Do., East	89·0	61·0	75·0	28·1	—1·3	—1·4	+0·1
19. Gujarat	91·5	65·6	78·6	25·9	—0·6	+0·2	—0·8
20. Central India, West	90·7	60·6	75·7	30·1	—0·9	—0·2	—0·7
21. Do. do., East	88·8	58·8	73·8	30·0	—2·5	—2·1	—0·4
22 Berar	94·1	66·6	80·3	27·5	—2·7	—1·7	—1·0
23. Central Provinces, West	90·8	61·7	76·3	29·1	—3·7	—2·4	—1·3
24. Do. do., East	90·7	63·2	76·9	27·5	—4·1	—2·5	—1·6
25. Konkan	87·2	71·8	79·5	15·4	+0·3	—1·4	+1·7
26. Bombay Deccan	94·6	63·6	79·1	31·0	—2·1	—1·8	—0·3
27. Hyderabad, North	93·1	67·2	80·2	25·9	—3·5	—1·3	—2·2
28. Do., South	94·1	69·8	81·9	24·3	—3·3	—1·9	—1·4
29. Mysore	90·2	65·4	77·8	24·8	—2·5	—0·7	—1·8
30. Malabar	89·0	75·5	82·3	13·5	—0·4	—0·4	0
31. Madras, South-east	91·6	72·7	81·9	18·8	—1·5	+0·2	—1·7
32. Do. Deccan	96·8	71·0	83·9	25·8	—4·2	—1·8	—2·4
33. Do. Coast, North	89·2	71·7	80·5	17·5	—1·5	—1·4	—0·1

TABLE 11.

DIVISION.	DEPARTURE FROM NORMAL OF		
	Mean maximum temperature.	Mean minimum temperature.	Mean temperature.
	°	°	°
Burma	—0·6	+0·5	0
Assam	—0·6	—0·4	—0·5
Bengal	—1·3	—1·7	—1·5
Bihar and Orissa	—1·4	—1·6	—1·5
United Provinces	—2·0	—1·3	—1·7
Punjab	+0·3	—0·9	—0·3
North-West Frontier Province	—0·7	—1·3	—1·1
Sind	—1·0	—0·5	—0·7
Rajputana	—0·7	—1·5	—1·1
Bombay	—0·9	—0·8	—0·9
Central India	—1·7	—1·2	—1·5
Central Provinces	—3·5	—2·2	—2·9
Hyderabad	—3·4	—1·7	—2·5
Mysore	—2·5	—0·7	—1·6
Madras	—1·7	—0·6	—1·2

Winds.

11. (*a*) The rate of air movement was appreciably less than usual in Bengal, the North-West Frontier Province, Sind, Central India and Hyderabad, and was well above the normal in the Punjab and Mysore.

(*b*) The steadiness was low in Burma, Bengal, Bihar and Orissa, the United Provinces, Central India and Mysore, but was high in Assam, Rajputana, Bombay and Hyderabad.

(*c*) Winds were more westerly or less southerly than usual in south Bengal, thus indicating a diminished inflow of moist air from the head of the Bay into north-east India. At the level of Darjiling, where as a rule south-east winds prevail, the actual direction was due west.

TABLE 12.

DIVISION.	DEPARTURE FROM NORMAL OF	
	Hourly wind velocity.	Wind steadiness.
Burma	0·	—13
Assam	0	+15
Bengal	—0·9	—11
Bihar and Orissa	—0·2	— 6
United Provinces	—0·2	—12
Punjab	+1·2	+ 2
North-West Frontier Province	—0·3	— 2
Sind	—1·2	— 3
Rajputana	+0·3	+ 8
Bombay	—0·4	+ 8
Central India	—0·5	—21
Central Provinces	0	— 2
Hyderabad	—0·6	+14
Mysore	+0·8	— 9
Madras	+0·4	+ 1

Humidity and cloud.

12. There was more than the customary amount of vapour in the air in lower Sind, the east of the Central Provinces and locally in the Madras Deccan, and the relative humidity also was above normal in these areas as well as in the east of Central India. The air was on the other hand drier than usual in both respects in the Punjab and the North-West Frontier Province; while in Bengal, Bihar, Orissa, Hyderabad and Mysore a low vapour pressure was associated with a nearly normal relative humidity. Elsewhere the departures from normal were small and of no significance.

The distribution of cloud agreed in its main features with that of rainfall. There was considerably less cloud than usual in Kashmir, Sind, Rajputana, the south-west Punjab, Central India West, Bengal and Assam, but in most other parts of the country the cloud amount was either about the average or in excess.

TABLE 13.

DIVISION.	HYGROMETRY; 8 HRS.				CLOUD.	
	Mean humidity.	Departure from normal.	Mean vapour tension in inches of mercury.	Departure from normal in inches of mercury.	Mean cloud amount at 8 hrs.	Departure from normal.
	%					
Burma	74	— 1	·641	—·015	3·3	+0·8
Assam	81	— 2	·522	—·018	3·0	—1·1
Bengal	76	— 1	·595	—·043	2·3	—0·7
Bihar and Orissa	69	— 1	·462	—·031	2·3	+0·2
United Provinces	53	— 2	·358	—·025	1·8	0
Punjab	53	— 8	·303	—·051	3·1	—0·2
North-West Frontier Province.	63	— 5	·304	—·055	3·9	—0·1
Sind	62	+ 8	·448	+·042	1·4	—0·9
Rajputana	37	— 3	·267	—·028	1·9	—0·4
Bombay	57	— 2	·486	—·020	1·6	+0·2
Central India	43	+ 1	·313	—·009	1·8	—0·2
Central Provinces	45	+ 4	·362	+·014	2·0	+0·4
Hyderabad	51	— 1	·472	—·036	1·8	+0·6
Mysore	60	— 2	·485	—·046	2·5	+0·7
Madras	74	+ 1	·736	—·017	2·9	+0·6

Rainfall.

13. Weather was unsettled almost continuously over northern India owing to the advance into that area of several disturbances of the cold weather type from the high lands to the west of the Indus, but the associated precipitation was comparatively light except along the North-West Frontier. Further the usual influx of comparatively moist air across the Bengal coast was very weak and unusually dry weather accordingly prevailed over north-east India during the greater part of the month.

Series of thunderstorms occurred in the Peninsula including the Central Provinces, chiefly during the fourth week, and were in many places attended with heavier rain than is ordinarily the case.

On the south coast of Burma thundershowers were of almost daily occurrence from the 19th onwards; while in the interior of Burma the weather was drier even than usual.

The total rainfall of the month was below the normal in Upper Burma, Assam, Bengal, Chota Nagpur, Bihar, the Punjab and Kashmir, and normal or in excess over the rest of the country. The largest defect occurred in Assam which received 1¼″ against a normal of about 4″, while in the region of excess the fall was unusually heavy for the time of year in the Bay Islands (+2¼″ or 469 per cent.) and Hyderabad South (+1¼″ or 321 per cent.).

The distribution of rainfall was thus rather unusual, and in north-east India it was in marked contrast to that of February.

TABLE 14.

SUB-DIVISION.	NUMBER OF RAINY DAYS.		RAINFALL.			
	Actual.	Normal.	Actual.	Normal.	Departure from normal.	Percentage departure from normal.
			″	″	″	
1. Bay Islands	4·5	0·7	2·73	0·48	+ 2·25	+469
2. Lower Burma	1·5	0·7	1·00	0·56	+ 0·44	+ 79
3. Upper Burma	0·3	0·9	0·08	0·46	— 0·38	— 83
4. Assam	3·8	6·5	1·28	3·89	— 2·61	— 67
5. Bengal	1·6	2·3	0·71	1·56	— 0·85	— 54
6. Orissa	2·4	1·9	1·23	1·13	+ 0·10	+ 9
7. Chota Nagpur	1·7	1·8	0·64	0·84	— 0·20	— 24
8. Bihar	1·1	1·0	0·37	0·47	— 0·10	— 21

Sub-division.	Number of rainy days.		Rainfall.			
	Actual.	Normal.	Actual.	Normal.	Departure from normal.	Percentage departure from normal.
			"	"	"	
9. United Provinces, East	0·8	0·7	0·26	0·28	— 0·02	— 7
10. Do. do., West	1·8	1·1	0·62	0·51	+ 0·11	+ 22
11. Punjab, East and North	1·3	1·7	0·40	0·81	— 0·41	— 51
12. Do., South-west	1·3	1·5	0·44	0·54	— 0·10	— 19
13. Kashmir	5·3	5·8	2·56	3·90	— 1·34	— 34
14. North-West Frontier Province	4·4	3·9	2·18	1·99	+ 0·19	+ 10
15. Baluchistan	3·5	3·3	1·61	1·29	+ 0·32	+ 25
16. Sind	0·5	0·5	0·17	0·19	— 0·02	— 11
17. Rajputana, West	0·3	0·4	0·07	0·12	— 0·05	— 42
18. Do., East	0·6	0·5	0·21	0·19	+ 0·02	+ 11
19. Gujarat	0	0·1	0	0·04	— 0·04	—100
20. Central India, West	0·2	0·3	0·05	0·12	— 0·07	— 58
21. Do. do., East	1·3	0·6	0·78	0·22	+ 0·56	+255
22. Berar	1·5	0·7	0·76	0·28	+ 0·48	+171
23. Central Provinces, West	1·7	0·9	0·76	0·42	+ 0·34	+ 81
24. Do. do. East	2·1	1·2	1·03	0·58	+ 0·45	+ 78
25. Konkan	0·2	0·1	0·10	0·06	+ 0·04	+ 67
26. Bombay Deccan	0·6	0·3	0·28	0·15	+ 0·13	+ 87
27. Hyderabad, North	1·5	0·8	0·88	0·38	+ 0·50	+132
28. Do., South	1·4	0·7	1·60	0·38	+ 1·22	+321
29. Mysore	1·1	0·6	0·60	0·30	+ 0·30	+100
30. Malabar	1·8	0·9	1·19	0·50	+ 0·69	+138
31. Madras, South-east	1·8	0·8	1·17	0·51	+ 0·66	+129
32. Do. Deccan	0·6	0·1	0·35	0·17	+ 0·18	+106
33. Do. Coast, North	0·6	0·9	0·41	0·50	— 0·09	— 18

TABLE 15.

Division.	Rainfall.			
	Actual.	Normal.	Departure from normal.	Percentage departure from normal.
	"	"	"	
Burma	0·44	0·50	—0·06	— 12
Assam	1·28	3·89	—2·61	— 67
Bengal	0·71	1·56	—0·85	— 54
Bihar and Orissa	0·66	0·72	—0·06	— 8
United Provinces	0·46	0·40	+0·06	+ 15
Punjab	0·41	0·74	—0·33	— 45
North-West Frontier Province	2·18	1·99	+0·19	+ 10

Division.	Rainfall.			
	Actual.	Normal.	Departure from normal.	Percentage departure from normal.
	"	"	"	
Sind	0·17	0·19	—0·02	— 11
Rajputana	0·17	0·17	0	0
Bombay	0·16	0·10	+0·06	+ 60
Central India	0·42	0·17	+0·25	+147
Central Provinces	0·87	0·44	+0·43	+ 98
Hyderabad	1·17	0·38	+0·79	+208
Mysore	0·60	0·30	+0·30	+100
Madras	0·85	0·47	+0·38	+ 81
Mean of India	0·58	0·61	—0·03	— 5

Snowfall.

I.—AFGHANISTAN.

14. No information is available, but heavy rain is reported to have fallen in the province of Jalalabad.

II.—NORTH-WEST FRONTIER PROVINCE.

(*a*) *Wano.*—Snow fell from the 23rd to the 25th to a total depth of about 1⅔′ on the Pirghal and Marwatti ranges and 11″ on the Jani Mela; but it soon melted away.

(*b*) *Kohat.*—A light fall occurred on the Samana range on the 22nd.

III.—KASHMIR.

(*a*) *Srinagar.*—On the surrounding mountains snowfall occurred on the 2nd, 21st and 27th, and in the valley on the 2nd.

(*b*) *Skardu.*—Slight falls were observed on the high ranges on the 1st, 17th, 18th, 22nd and 29th.

(*c*) *Dras.*—Snow fell on thirteen days; the total fall in the grounds of the observatory measured a little over 2′.

(*d*) *Kargil.*—Light snowfall occurred in and around Kargil on the 2nd, 3rd, 8th, 9th, 16th and 19th. Accumulations on the hills at the end of the month nowhere exceeded one foot in depth.

IV.—PUNJAB.

Kilba (*Simla Hills*).—On the ranges near Kilba snowfall occurred on twelve days; the lowest descent was to 7,000 feet. At the end of the month the Harang pass was clear of snow, but the Shatul, Brua and Rupin passes had still 5′, 4′ and 3′ of snow respectively on them and were accordingly not passable.

V.—UNITED PROVINCES.

(*a*) *Garhwal.*—Snow to a depth of about 3½′ fell on the 7th on the high peaks in the north and south of the district.

(*b*) *Almora.*—The total fall of the month was estimated at about 7′ in Byans, 5′ in Malla Danpur and Darma, 3½′ in Chaudas and 1′ in Malla Johar. The snowline descended to a distance of 6 miles below the perpetual snows in Byans, 5 miles in Malla Darma, 3 miles in Malla Danpur and 1¼ miles in Chaudas.

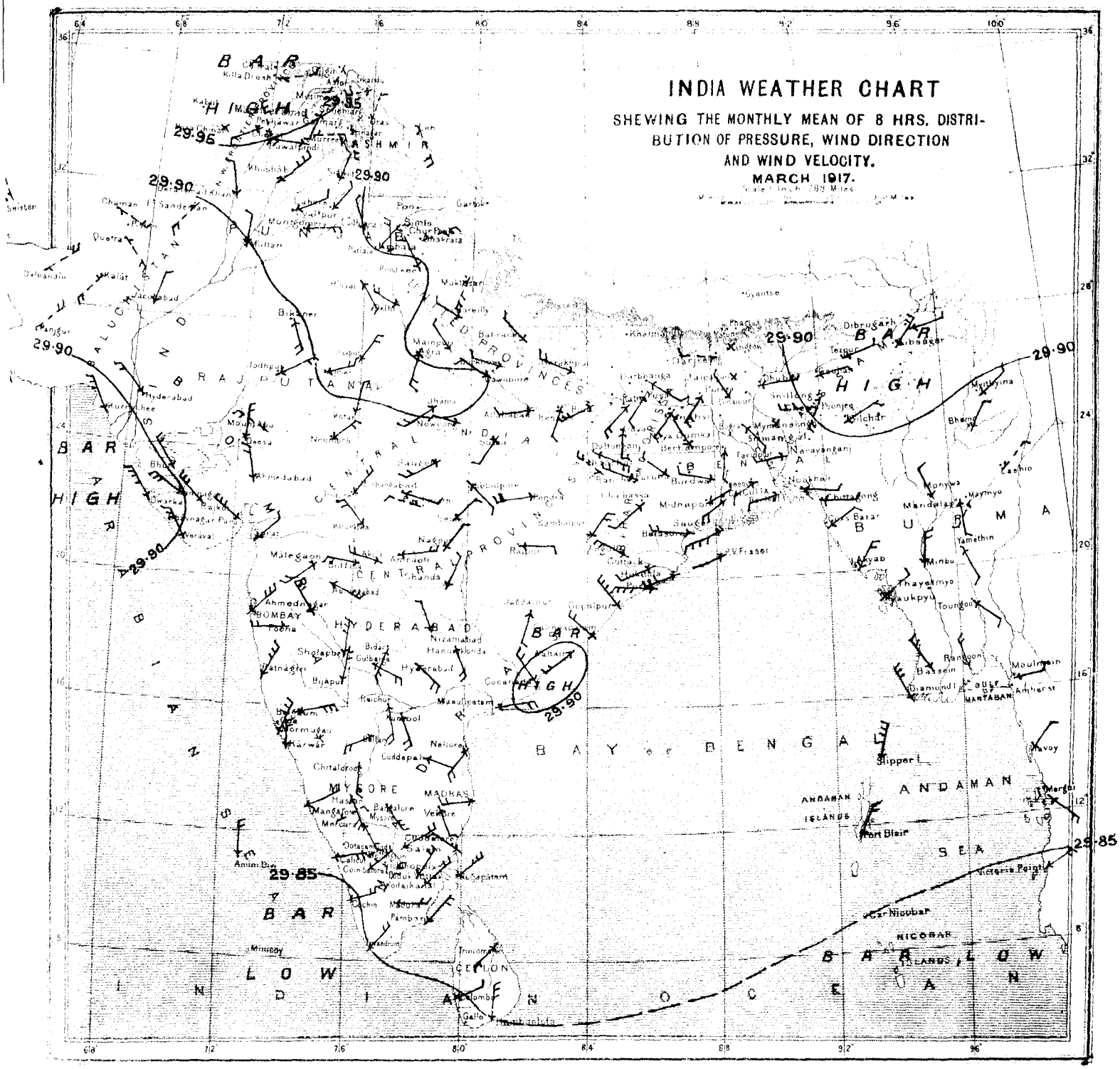
TABLE 16.

Name of pass or peak.	Depth of accumulation at the end of the month.	
	Reported.	Normal.
	Feet.	Feet.
Nuwe pass	19	31
Binkaru ,, ...	8	20
Lampia ,, ...	8	18½
Lipulekh ,, ...	7	18⅔
Kuntela peak	5	5½
Kaphini ,, ...	5	5½
Milamdhura	½	7½
Bagdwar	¼	...

SUMMARY.

15. There was on the whole appreciably less than the usual amount of snowfall, and the accumulations existing at the end of the month were in general distinctly below the average.

HEM RAJ.

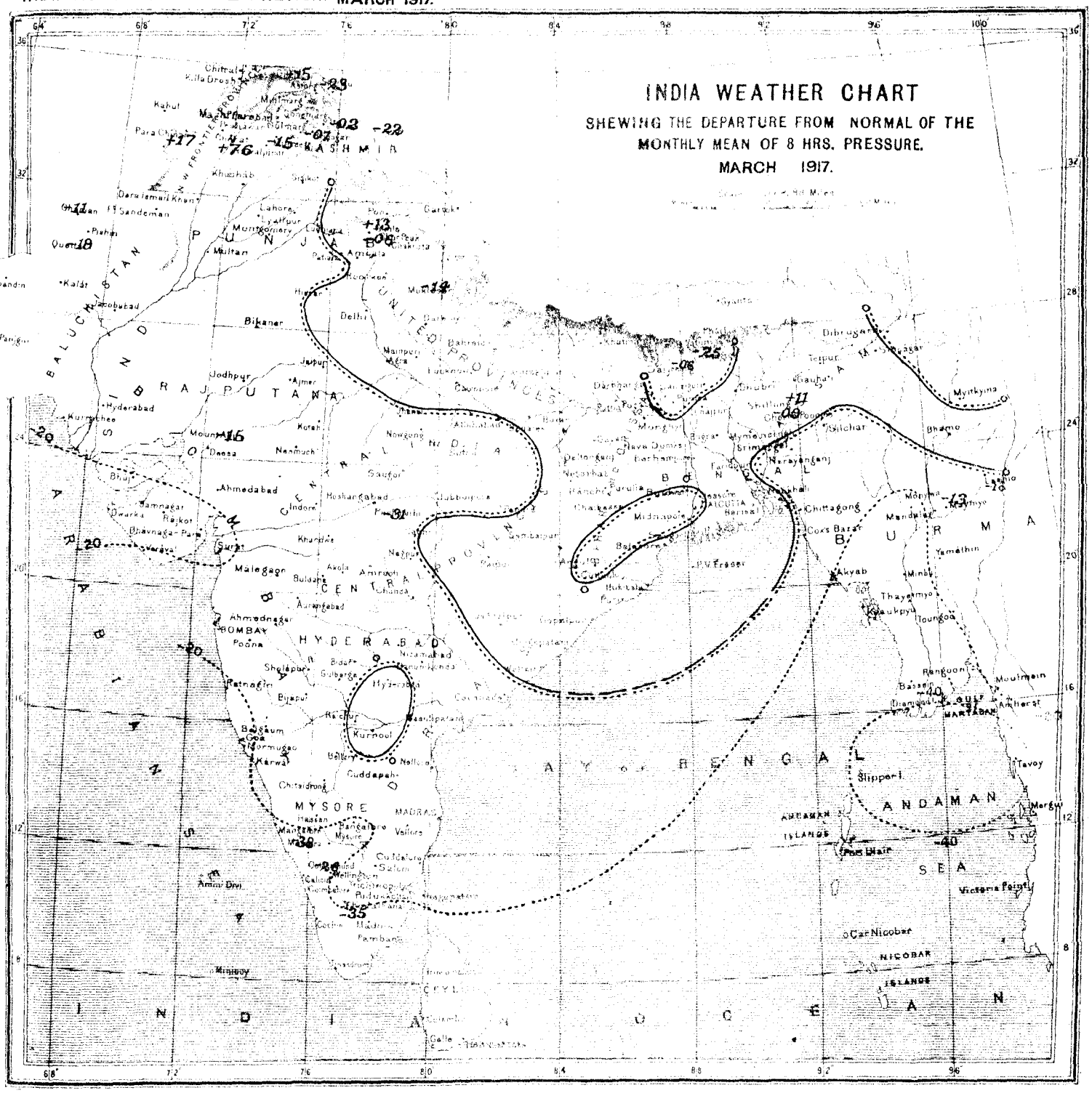


The lines of the above chart represent isobars or lines of equal barometric pressure, the numbers attached indicating the barometric pressure in inches and being drawn for differences of pressure of ·05 inch. The isobars in the Bay of Bengal are filled in by means of the shore observations, and by comparison with the normal distribution of pressure.

The mean 8 hrs. wind directions of the month are shewn by means of arrows flying with the wind, and are calculated by means of Lambert's formula applied to the winds as given in Table B of the 8 hrs. observations. The mean wind directions for the hill stations are indicated by broken arrows to distinguish them from the wind arrows for the plain stations. The mean velocity of the winds during the month is shewn by the following notation:—

Velocity of	0 to 2	miles per hour	...	one	feather	added to the wind arrow.					
,,	,, 2 to 5	,,	,,	,,	...	two	feathers	,,	,,	,,	,,
,,	,, 5 to 10	,,	,,	,,	...	three	,,	,,	,,	,,	,,
,,	,, 10 to 20	,,	,,	,,	...	four	,,	,,	,,	,,	,,
	over 20	,,	,,	,,	...	five	,,	,,	,,	,,	,,

Wind strengths are based on factor 2·2 for the standard type of Beckley Robinson anemograph, instead of 3·0 as used for this plate up to December 1911 inclusive.



The chart shows the departure from normal of the mean during the month of 8 hrs. pressure by means of lines drawn for equal amounts of departure. The numbers are given in thousandths of an inch, 20 representing ·020′ or two hundredths of an inch, &c. Continuous lines indicate that the pressure was in excess by amounts indicated by the numbers attached to the lines, and broken or dotted lines that it was in defect by amounts indicated by the numbers attached to the lines. Two parallel lines near to each other, one continuous and the other broken or dotted, represent the line of no departure, the dotted line facing the area of deficient pressure or negative departures.

CHART SHEWING THE DEPARTURE FROM NORMAL
OF THE MONTHLY MEAN OF DAILY
MAXIMUM TEMPERATURE.

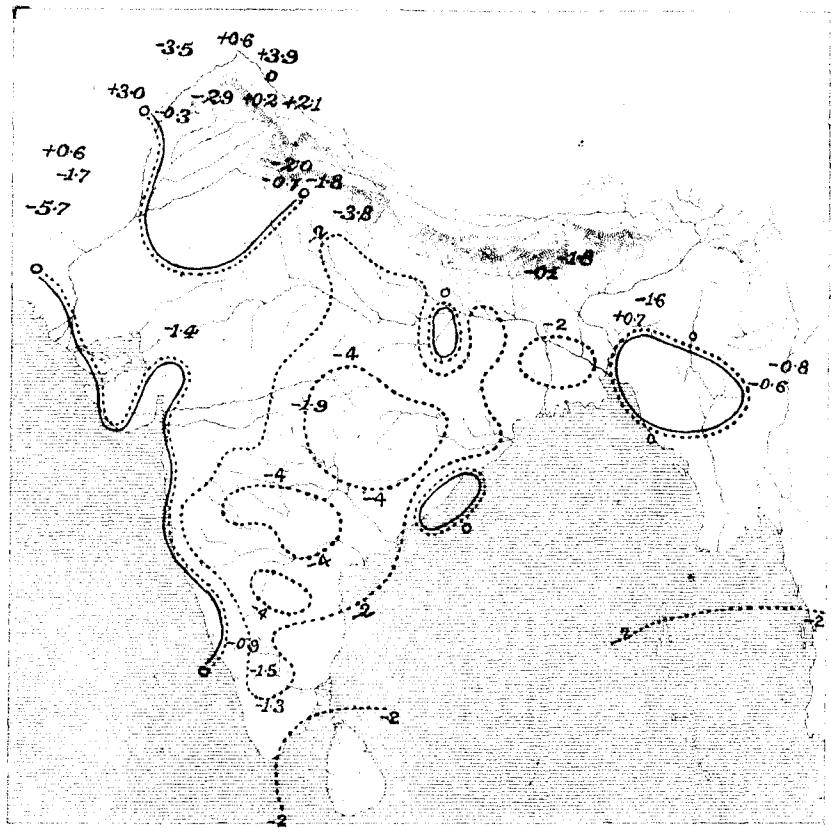


CHART SHEWING THE DEPARTURE FROM NORMAL
OF THE MONTHLY MEAN OF DAILY
MINIMUM TEMPERATURE.

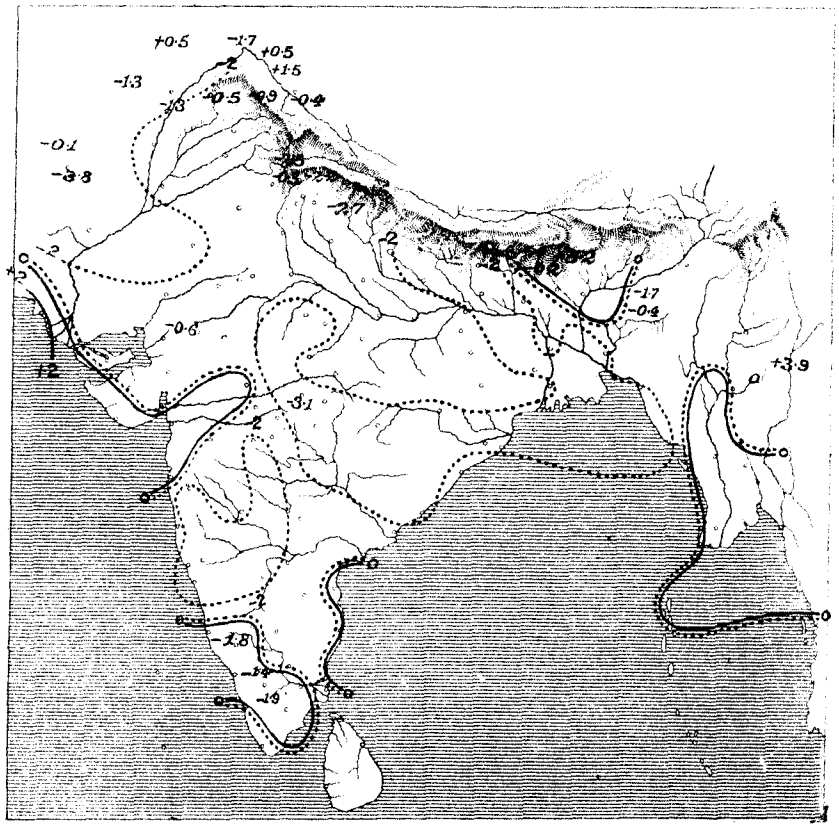


CHART SHEWING THE DEPARTURE FROM NORMAL
OF THE MONTHLY MEAN OF DAILY
MEAN TEMPERATURE.

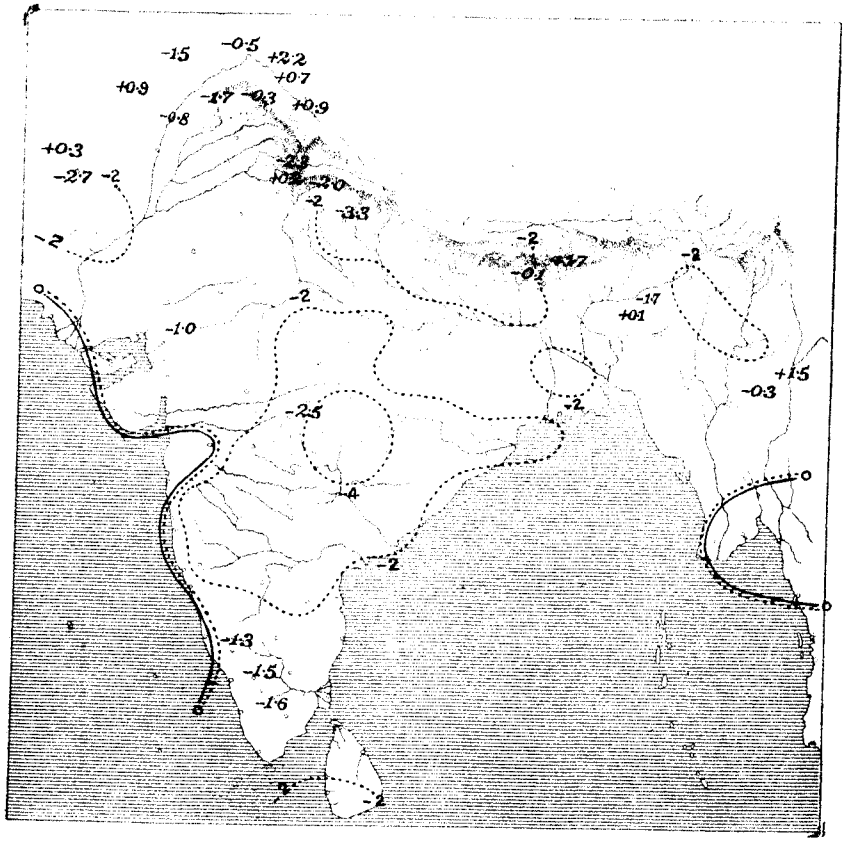


CHART SHEWING THE DEPARTURE FROM NORMAL
OF THE MONTHLY MEAN OF ABSOLUTE
HUMIDITY AT 8 HRS.

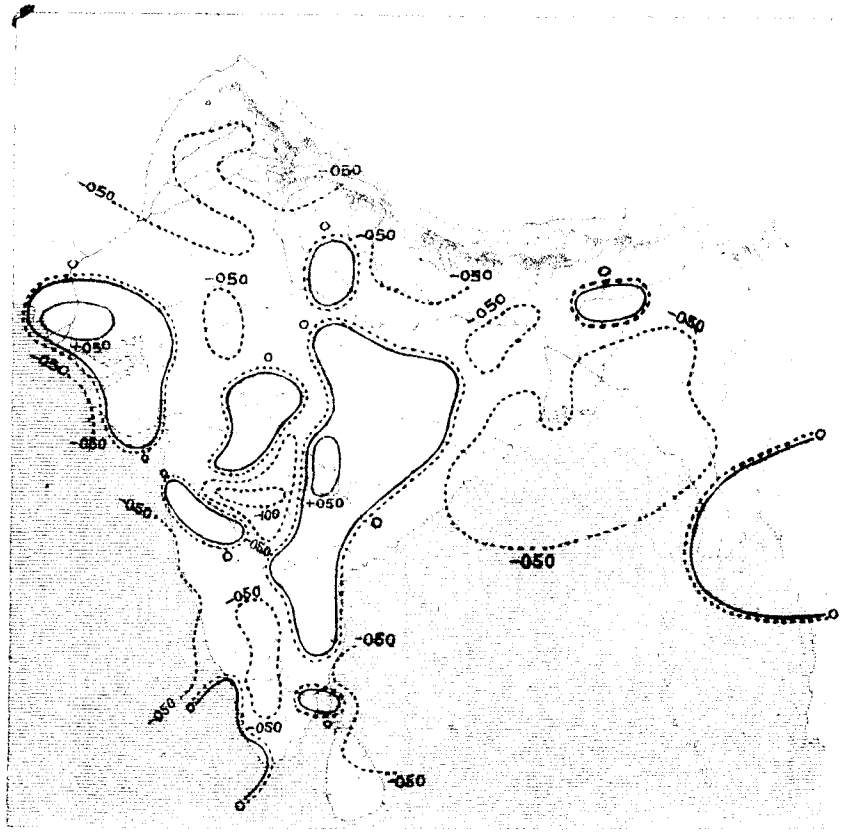


CHART SHEWING THE DEPARTURE FROM NORMAL
OF THE MONTHLY MEAN OF RELATIVE
HUMIDITY AT 8 HRS.

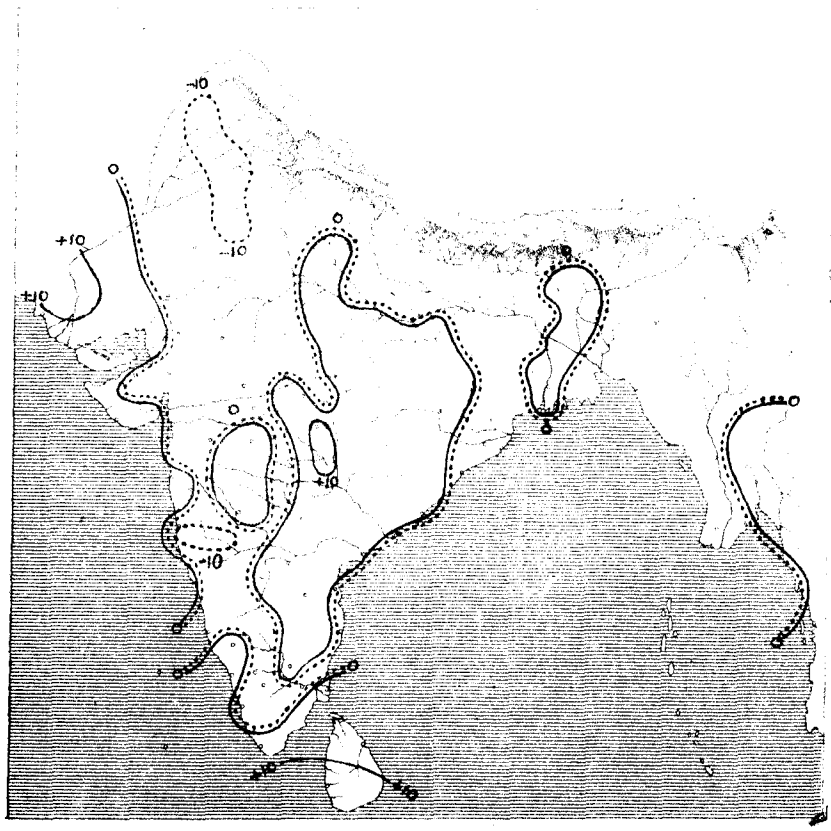


CHART SHEWING THE DEPARTURE FROM NORMAL
OF THE MONTHLY MEAN OF CLOUD
AMOUNT AT 8 HRS.

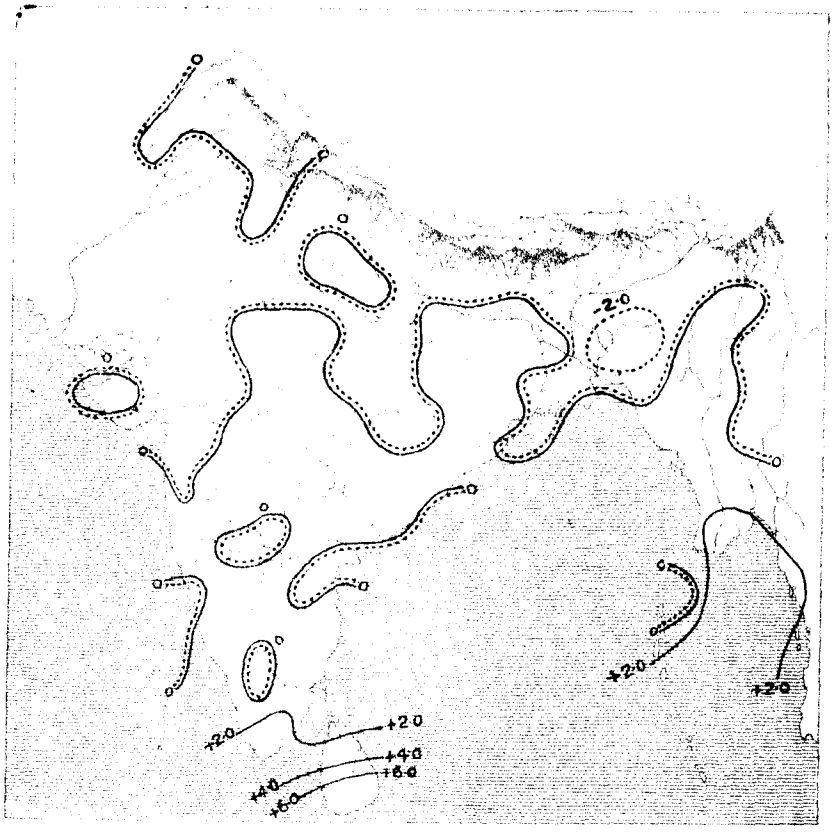
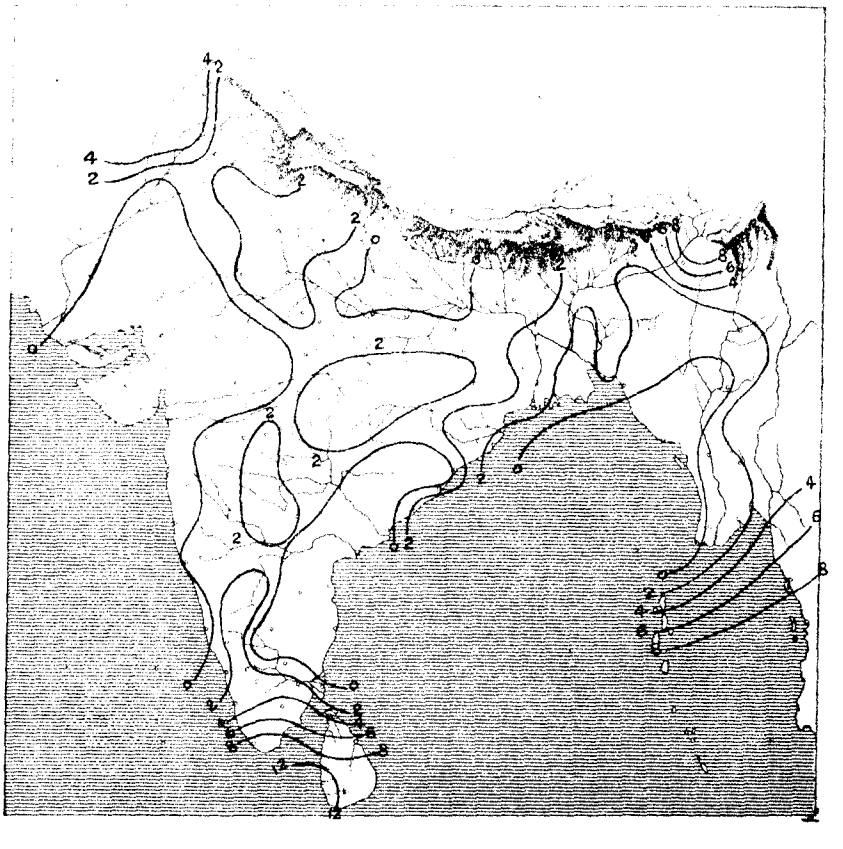
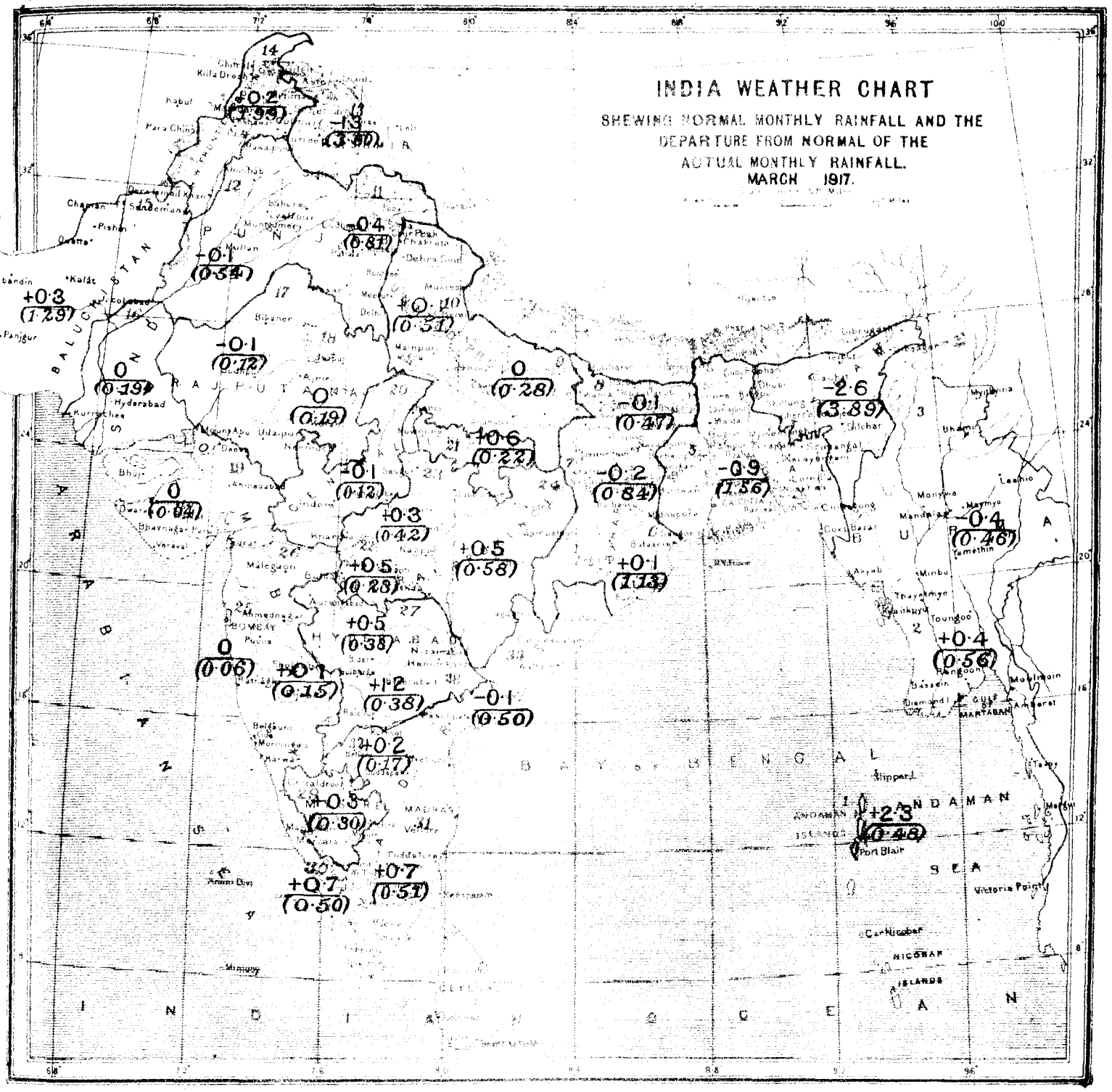


CHART SHEWING THE TOTAL NUMBER OF DAYS IN THE
MONTH ON WHICH RAINFALL EQUALLED OR
EXCEEDED 0·10 INCH.
(BASED ON THE RETURNS OF TABLE B.)





The country is divided into 33 areas as shewn in the list below. The numbers in that list correspond with the red numbers on the chart, and serve to identify the areas. The numbers in brackets on the chart give the average over the divisions of the normal monthly rainfall, the numbers above these give the departures from normal of the average actual rainfall over the divisions.

1. Bay Islands
2. Lower Burma
3. Upper Burma
4. Assam
5. Bengal
6. Orissa
7. Chota Nagpur
8. Bihar
9. United Provinces, East
10. United Provinces, West
11. Punjab, East and North
12. Do., Southwest
13. Kashmir
14. Northwest Frontier Province
15. Baluchistan
16. Sind
17. Rajputana, West
18. Rajputana, East
19. Gujarat
20. Central India, West
21. Do., East
22. Berar
23. Central Provinces, West
24. Do., East
25. Konkan
26. Bombay, Deccan
27. Hyderabad, North
28. Hyderabad, South
29. Mysore
30. Malabar
31. Madras, Southeast
32. Madras, Deccan
33. Madras Coast, North

GOVERNMENT OF INDIA

METEOROLOGICAL DEPARTMENT

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INTRODUCTION

THIS review of the weather in India during the month of April, 1917, is based on observations taken daily at 8 hrs. at 214 stations, and on additional observations taken at 10 hrs. and 16 hrs. at 11 stations. In the rainfall summary have been utilized the data furnished by the meteorological observatories, and the rainfall statements of the month published by the Provincial Governments. The brief notes on solar, magnetic and seismic disturbances are supplied by the chief observatories in the Indian area.

For a statement of the methods adopted in recording and tabulating the data for each of the elements of observation, reference should be made to the introductory portion of the review for January.

Summary of the chief features of the weather in India during the month.

2. Meteorologically April was very abnormal. Several depressions of the winter type appeared over north-west India, and produced precipitation chiefly in Kashmir, Rajputana, the Punjab and the adjoining districts of the United Provinces. Unusually late snowfall occurred in Simla on the 11th and 22nd. An important effect of these cold weather disturbances was to hinder the proper development of hot weather actions, and in most of north-east India, Lower Burma and the Peninsula the usual thundershowers were comparatively rare.

The total rainfall of the month was unusually heavy for the time of year in the Punjab, Rajputana, Gujarat and the west of the United Provinces, the excess amounting to about 1½″ or 326 per cent. in the Punjab East and North. It was in appreciable excess also in Kashmir and Hyderabad North, but was normal or in defect in the remainder of the country. The deficit was about 2″ in the Bay Islands, Assam and Malabar, and a little over an inch in Madras South-east.

Of the climatic elements other than rainfall, humidity was appreciably low in upper Assam, Bihar, Chota Nagpur and Kashmir, and high in the Punjab, Rajputana and parts of Sind; while the quantity of cloud was in marked defect generally in north-east India, Kashmir, Mysore and north and central Madras, and above normal in the United Provinces, the Punjab, Rajputana, Gujarat, Central India and parts of Burma. Maximum and minimum temperatures were both below the normal in the United Provinces, the Punjab, Rajputana, Central India and the Central Provinces, the former however to a greater extent than the latter. Weather was slightly cooler than usual also in Upper Burma, Bihar, Chota Nagpur, the North-West Frontier Province, the Bombay Deccan and Hyderabad, but in all other parts of the country temperature conditions were fairly normal.

Barometric pressure at the level of the plains was ·011″ in defect.

Solar, magnetic and seismic disturbances.

KODAIKANAL OBSERVATORY.

3. *Solar observations.*—Complete solar observations were made on all the days during the month.

Sunspots.—Twenty-six new groups of spots were observed as against twenty-four in March. The daily average number was 5·1 and the average life of a spot was 6·8 days, the averages for the preceding month being 5·6 and 6·5

respectively. The distribution of the spots in latitude was as follows:—

TABLE 1.

—	0° – 10°	11°–20°	21°–30°	Mean latitude.	Extreme latitudes.
North . . .	3	7	2	14°·7	6° & 23°
South . . .	1	8	5	18°·5	9° & 30°

Prominences.—One hundred and ten large, one eruptive, and two metallic prominences were recorded during the month. The highest was an eruptive prominence observed on the 19th at latitude + 15° east which reached a height of 450″.

Magnetic disturbances.—"Moderate" magnetic disturbances were recorded on the following dates:—9th, 15th, 16th, 25th, 26th, 29th, and 30th.

J. EVERSHED,
Director,
Kodaikanal and Madras Observatories.

Seismic records.

$\phi = 10° 13' 50''$ N; $\lambda = 77° 28' 00''$ E; $h = 2343$ m. *Subsoil* Rock.

Apparatus.—Milne's Horizontal Pendulum Seismograph.

TABLE 2.

	V	T_0	C	$\frac{r}{T_0^2}$
AN:				
AE:	9·16	17·2	1	2·6
AZ:				

Date.	Phase.	Time G. M. T.	Period (Sec.)	Amplitude (u) AN.	AE.	AZ.	Distance Δ (Km.)	Remarks.
1917.		h. m. s.						
April 3rd	e P	12 48 12	...	...	...	...	...	
	i L	12 52 48	...	...	...	...	...	
	M	12 54 00	...	...	100	...	...	
	F	13 38 36	...	...	...	...	...	
„ 12th	e P	2 59 12	...	...	...	...	...	
	i L	3 04 18	...	...	...	...	...	
	M	3 13 42	...	...	50	...	...	
	F	3 44 12	...	...	...	...	...	
1917.		h. m. s.						
April 17th	e P	18 55 42	...	...	...	...	...	
	e L	18 59 00	...	...	...	...	...	
	M	19 02 30	...	...	120	...	...	
	F	19 37 06	...	...	...	...	...	
„ 21st	P	.....	...	...	...	...	...	
	i L	0 59 30	...	...	...	...	...	
	M	1 05 06	...	...	190	...	...	
	F	1 34 06	...	...	...	...	...	
„ 29th	e P	12 13 42	...	...	...	...	...	
	i L	12 25 12	...	...	...	...	...	
	M	12 30 12	...	...	80	...	...	
	F	12 56 24	...	...	...	...	...	

T. ROYDS,
Assistant Director.

BOMBAY OBSERVATORY.

Alibag magnetic record.

4. During the month of April, 1917, the traces showed 12 calm days, 17 days of small and 1 day of moderate disturbance.

The days of the month selected as "quiet" for the purposes of the Magnetic Survey of India are the 1st, 11th, 14th, 20th and 28th.

The following table represents the magnetic character of each day during the month:—

TABLE 3.

Day.	Character.	Day.	Character.	Day.	Character.	Day.	Character.
1	C	9	S	17	C	25	S
2	S	10	S	18	S	26	M
3	S	11	C	19	S	27	C
4	S	12	C	20	C	28	C
5	S	13	C	21	C	29	C
6	S	14	C	22	S	30	S
7	S	15	S	23	C		
8	S	16	S	24	S		

C.=calm; S.=small; M.=moderate; G.=great; V. G.=very great.

The mean observed absolute values of the several magnetic elements reduced to the mean monthly tabulations of the magnetcgrams, as also the ranges and the summed ranges of the horizontal force and declination for the month are as follows :—

Easterly declination	0° 33′ 29″.
Horizontal force	0·36881 C.G.S. unit.
Vertical force	0·16161 C.G.S. „
Inclination	24° 34′·1.
Horizontal force range . . .	0·00066 C.G.S. unit.
Horizontal force summed range . .	0·00433 C.G.S. „
Declination range	4′·3.
Declination summed range . . .	16′·9.

(NOTE.—Summed range means sum without regard to sign of 24 ordinates of the diurnal inequality.)

Seismic records.

$\phi = 18° 53′ 36″$ N; $\lambda = 72° 48′ 56″$ E; $h = 11$m. *Subsoil* Trap.

Apparatus.—Milne's Horizontal Pendulum Seismograph.

TABLE 4.

	V	To	ϵ	$\frac{r}{To^2}$
AN:				
AE:	9	21	1	
AZ:				

Date.	Phase.	Time G. M. T.	Period (Sec.)	Amplitude (u) An.	Ae.	Az.	Distance Δ (Km.)	Remarks.
1917.		h. m. s.						
April 3rd	P	12 50 7	...	...	...	...	...	
	M	12 59 7	...	...	56	...	...	
	F	13 17 38	...	...	...	...	...	
„ 12th	P	3 0 14	...	...	...	...	...	
	M	3 10 7	...	...	189	...	...	
	F	3 36 43	...	...	...	...	...	
„ 14th	...	4 39 0	...	...	...	...	...	Thickening of line.
„ 16th	P	19 1 25	...	...	...	...	...	
	M	19 4 25	...	...	56	...	...	
	F	19 13 58	...	...	...	...	...	
April 20th	...	11 30 0	...	...	...	...	...	Thickening of line.
	...	12 10 0	...	...	...	...	...	Ditto.
„ 21st	P	*0 53 41	...	...	...	...	...	Beginning mixed in tremors.
	M	0 56 44	...	...	189	...	...	
	F	...	...	...	...	...	...	End mixed in tremors.
„ 24th	...	3 36 0	...	...	...	...	...	Thickening of line.
„ 29th	P	12 13 12	...	...	...	...	...	
	M	12 23 53	...	...	33	...	...	
	F	12 38 0	...	...	...	...	...	

Sensibility to tilt 1·0 mm. of amplitude on the trace = 0″·32.

* This value is as shown by the float record.

N. A. F. MOOS,

Director,

Bombay and Alibag Observatories.

5.—CALCUTTA (ALIPORE) OBSERVATORY.

Seismic records.

$\phi = 22° 32′$ N; $\lambda = 88° 20′$ E; $h = 6·4m.$ *Subsoil Alluvial.*

Apparatus.—Two Omori Ewing Horizontal Pendulum Seismographs.

TABLE 5.

	V	To	ϵ	$\frac{r}{To^2}$
AN:	29	18	1	
AE:	29	42	1	
AZ:				

Date.	Phase.	Time G. M. T.	Period (Sec.).	Amplitude (u). An.	Ae.	Az.	Distance Δ (Km.).	Remarks.
1917. April 12th	P	h. m. s. 2 57 00	?	...	...	...	...	
	S	?	?	...	...	...	...	
	L	2 58 36	12	...	...	...	...	
	M	2 59 30	...	1431	465	...	...	
	F	3 36 54	...	...	...	...	...	

Date.	Phase.	Time G. M. T.	Period (Sec.)	Amplitude (a) An.	Ae.	Az.	Distance △ (Km.)	Remarks.
		h. m. s.						
April 17th	P	13 33 18	6	...	...	...	...	
	S	13 34 18	9	...	...	...	...	
	L	13 36 12	12	...	...	...	...	
	M1	13 37 54	...	190	69	...	...	
	M2	13 39 06	...	103	...	...	...	
	F	14 01 54	...	...	...	...	...	
„ 21st	P	0 54 18	6	...	...	...	...	
	S	0 57 54	7	...	...	...	...	
	L	1 2 18	13	...	...	...	...	
	M	1 3 06	...	172	...	...	...	
	F	1 35 00	...	...	...	...	...	

6.—SIMLA OBSERVATORY.

The following table contains a list of earthquakes that were reported:—

TABLE 6.

Place at which felt.	Date.	G. M. T. of earthquake.	Duration.	Intensity Rossi-Forel scale.	Number of shocks.	Remarks.
		h. m.	Sec.			
Mandalay . . .	Apl. 17th	13 30	8	6	3	
Cherat . . .	„ 21st	0 10	2	6	2	
Kabul (Afghanistan .	Apl. 21st	0 45	100	7	2	
Parachinar . . .	„ 21st	0 45	40	6	1	
Mardan (District Peshawar).	„ 21st	0 48	65	4	1	
Srinagar . . .	„ 21st	0 50	18	7	1	
Sialkot . . .	„ 21st	0 50	6	6	2	
Rawalpindi . .	„ 21st	0 50	30	6	2	
Lahore . . .	„ 21st	0 55	15	5	2	
Drosh . . .	„ 21st	0 55	40	8	3	
Dera Ismail Khan .	„ 21st	0 56	14	8	3	
Mukteswar . . .	„ 24th	14 43	10	6	1	
Shillong . . .	„ 28th	5 37	1	6	1	
Borjuli (District Darrang, Assam).	„ 28th	17 45	4	5	1	
Salonah (District Nowgong, Assam).	„ 30th	9 18	5	6	1	
Borjuli (District Darrang, Assam).	„ 30th	9 41	7	4	1	

The Simla Seismograph notes will appear in a future number of this Review.

Solar radiation.—Observations not recorded owing to the absence of officers on war service.

C. W. B. NORMAND,
Imperial Meteorologist, Simla.

Weather in the Indian Ocean.

7. In the west of the equatorial belt atmospheric pressure was normal at Zanzibar and slightly lower than usual at Seychelles. Winds were weak but approximately normal in direction at Zanzibar, and were strong at Seychelles where the direction differed largely from the normal. Rainfall was appreciably above the average. The absence of northerly winds at Seychelles would indicate that the transition from the winter to the summer conditions was occurring more rapidly than usual.

TABLE 7.

	Mauritius.	Zanzibar.	Seychelles.
Departure from normal of mean pressure	...	+ ·001	— ·011
Actual mean wind direction . .	...	S 28° W	S 53° E
Normal mean wind direction . .	...	S 15° W	N 8° E
Actual mean wind velocity (miles per diem).	...	110	99
Normal mean wind velocity (miles per diem).	...	125	82
Rainfall departure from normal . .	...	+ 2·64	+ 2·34

Depressions and cyclonic storms.

8. In north-west India April usually witnesses the establishment of the conditions characteristic of the hot season and most of the disturbances which occur during the month are locally formed and of thermal origin. In the month under review no less than six disturbances affected the weather in that area, but all of them were the continuation of the depressions which had previously affected Persia, and therefore of the class of cold weather storms. Their influence on the weather was confined chiefly to Kashmir, the Punjab, Rajputana and the west of the United Provinces.

Pressure.

9. Atmospheric pressure averaged over the plains was in defect by ·011″. The deficiency was not however entirely general, for in the north-east Punjab and most of the United Provinces pressure tended to be high.

TABLE 8.

DIVISION.	Departure from normal of mean 8 hrs. pressure.
	″
Burma	—·025
Assam	—·035
Bengal	—·027
Bihar and Orissa	—·012
United Provinces	+·008
Punjab	+·001
North-West Frontier Province	—·033
Sind	—·022
Rajputana	—·017
Bombay	—·009
Central India	—·003
Central Provinces	—·004
Hyderabad	—·001
Mysore	—·010
Madras	—·013

The vertical gradient was steeper than usual in north-west and central India, and about normal in north-east India and the south of the Peninsula.

TABLE 9.

HILL STATION.	Departure from normal pressure. A	PLAIN STATION.	Departure from normal pressure. B	Departure of pressure difference. B—A.
	″		″	″
Quetta	—·061	Jacobabad	—·018	+·043
Leh	—·071	Lahore	—·002	+·069
Murree	—·073	Peshawar	—·035	+·038
Simla	—·049	Ludhiana	+·009	+·058
Darjiling	—·052	Dhubri	—·047	+·005
Mount Abu	—·040	Deesa	—·002	+·038
Pachmarhi	—·032	Khandwa	0	+·032
Kodaikanal	—·017	Madura	—·018	—·001

Temperature.

10. Mean monthly temperature was below the average by 6° in the Punjab, 5° in the United Provinces and Rajputana, 4° in Central India and the Central Provinces, 2½° in Hyderabad and 2° in Chota Nagpur, Bihar, the North-West Frontier Province, the Bombay Deccan and Upper Burma. The lowness in the first three areas persisted through a large part of the month and was on the whole more marked in the maximum than in the minimum temperature, the former at times being upwards of 20° below the normal at some stations. In recent years similar temperature conditions were recorded in April 1905, 1907, 1909, and 1914.

TABLE 10.

SUB-DIVISION.	ACTUAL TEMPERATURE.				DEPARTURE FROM NORMAL OF		
	Mean maximum.	Mean minimum.	Monthly mean of mean between maximum and minimum.	Mean daily range of temperature.	Maximum.	Minimum.	Daily range.
	°	°	°	°	°	°	°
1. Bay Islands	96·1	79·2	84·7	10·9	—0·8	+0·1	—0·9
2. Lower Burma	92·9	75·7	84·3	17·2	—0·6	+0·1	—0·7
3. Upper Burma	95·1	69·9	82·5	25·2	—1·8	—2·0	+0·2
4. Assam	86·2	65·8	76·0	20·4	+1·1	—1·2	+2·3
5. Bengal	93·8	72·3	83·1	21·5	+0·3	—1·3	+1·6
6. Orissa	97·2	74·8	86·0	22·4	—1·0	—1·5	+0·5
7. Chota Nagpur	98·5	70·5	84·5	27·9	—2·1	—1·8	—0·3
8. Bihar	97·6	69·9	83·7	27·7	—1·8	—2·6	+0·8
9. United Provinces, East	96·4	67·3	81·9	29·1	—4·8	—4·0	—0·8
10. Do. do., West	93·4	65·6	79·5	27·8	—7·2	—4·7	—2·5

Sub-division.	Actual temperature.				Departure from normal of		
	Mean maximum.	Mean minimum.	Monthly mean of mean between maximum and minimum	Mean daily range of temperature.	Maximum.	Minimum.	Daily range.
	°	°	°	°	°	°	°
11. Punjab, East and North	87·9	61·5	74·7	26·4	—7·3	—4·7	—2·6
12. Punjab South-west	89·7	63·0	76·3	26·7	—6·2	—3·7	—2·5
13. Kashmir	61·7	40·1	50·9	21·6	—0·8	—0·7	—0·1
14. North-West Frontier Province	86·8	60·7	73·7	26·1	—2·6	—2·1	—0·5
15. Baluchistan	81·9	52·0	66·9	29·8	—0·2	—1·4	+1·2
16. Sind	94·4	71·5	83·0	22·9	—1·2	—0·4	—0·8
17. Rajputana, West	95·5	68·2	81·9	27·3	—4·9	—5·5	+0·6
18. Do., East	94·6	69·0	81·8	25·7	—5·5	—4·0	—1·5
19. Gujarat	95·3	72·4	83·9	22·9	—2·7	—0·3	—2·4
20. Central India, West	95·7	68·3	82·0	27·5	—4·1	—2·1	—2·0
21. Do. do., East	96·3	67·1	81·7	29·1	—5·3	—4·3	—1·0
22. Berar	99·6	73·1	86·4	26·4	—4·0	—2·4	—1·6
23. Central Provinces, West	97·5	69·8	83·7	27·7	—5·2	—3·3	—1·9
24. Do. do., East	98·1	71·2	84·6	26·9	—3·8	—3·2	—0·6
25. Konkan	88·8	76·7	82·7	12·1	—0·5	—1·1	+0·6
26. Bombay Deccan	98·7	68·4	83·5	30·4	—1·8	—2·7	+0·9
27. Hyderabad, North	98·9	71·7	85·3	27·2	—2·5	—3·1	+0·6
28. Do., South	100·3	74·5	87·4	25·7	—1·9	—2·6	+0·7
29. Mysore	94·0	69·4	81·7	24·6	—0·1	—0·2	+0·1
30. Malabar	90·1	78·4	84·3	11·7	—0·4	+0·2	—0·6
31. Madras, South-east	96·6	77·5	87·1	19·1	+0·4	+0·1	+0·3
32. Do. Deccan	103·2	77·2	90·2	26·0	—1·2	—1·6	+0·4
33. Do. Coast, North	93·9	77·2	85·6	16·7	+0·5	—0·5	+1·0

TABLE 11.

Division.	Departure from normal of		
	Mean maximum temperature.	Mean minimum temperature.	Mean temperature.
	°	°	°
Burma	—1·2	—0·9	—1·1
Assam	+1·1	—1·2	0
Bengal	+0·3	—1·3	—0·5
Bihar and Orissa	—1·6	—2·1	—1·8
United Provinces	—5·8	—4·3	—5·0
Punjab	—7·0	—4·4	—5·7
North-West Frontier Province	—2·6	—2·1	—2·3

Division.	Departure from normal of		
	Mean maximum temperature.	Mean minimum temperature.	Mean temperature.
	°	°	°
Sind	—1·2	—0·4	—0·8
Rajputana	—5·3	—4·6	—5·0
Bombay	—1·9	—1·2	—1·5
Central India	—4·7	—3·2	—3·9
Central Provinces	—4·6	—3·1	—3·8
Hyderabad	—2·2	—2·8	—2·5
Mysore	—0·1	—0·2	—0·2
Madras	0	—0·3	—0·1

Winds.

11. (*a*) Winds were appreciably below their normal strength in Bengal, the North-West Frontier Province and Hyderabad, and stronger than usual in Burma, the Punjab, Rajputana and Madras.

(*b*) The degree of steadiness was high in Assam, the United Provinces, the Punjab, Sind, Bombay and Madras, and was low in Burma, Bengal, Bihar and Orissa, the North-West Frontier Province and Rajputana.

(*c*) Winds were less westerly or more southerly than usual in Rajputana and the east of Central India, and more northerly or less westerly in Berar and Hyderabad. At the level of Darjiling the predominant direction was N 59° E, as compared with S 28° E, the normal for the month.

TABLE 12.

DIVISION.	DEPARTURE FROM NORMAL OF	
	Hourly wind velocity.	Wind steadiness.
Burma	+0·4	— 6
Assam	—0·2	+ 8
Bengal	—0·6	—14
Bihar and Orissa	—0·3	— 7
United Provinces	+0·2	+14
Punjab	+0·7	+11
North-West Frontier Province	—0·9	— 4
Sind	—0·3	+11
Rajputana	+0·6	— 3
Bombay	—0·1	+ 7
Central India	—0·3	— 2
Central Provinces	0	+ 2
Hyderabad	—0·6	+ 2
Mysore	+0·1	+ 3
Madras	+0·7	+11

Humidity and Cloud.

12. Mean monthly absolute humidity was in large excess in the area defined by Jodhpur, Deesa and Hyderabad (Sind), and about normal or in defect elsewhere. The relative humidity was above the average in Rajputana, the Punjab, the north-west of the United Provinces, Central India East and parts of Sind and Gujarat, and was in defect in central Burma, upper Assam, north Bengal, Bihar, the north-east of the United Provinces and west Hyderabad.

The quantity of cloud was in defect in Assam, Bengal, Hyderabad, Mysore and Madras, about the average in Bihar and Orissa, Sind and the Central Provinces, and above the normal in the remaining divisions.

TABLE 13.

DIVISION.	HYGROMETRY; 8 HRS.				CLOUD.	
	Mean humidity.	Departure from normal.	Mean vapour tension in inches of mercury.	Departure from normal in inches of mercury.	Mean cloud amount at 8 hrs.	Departure from normal.
	%					
Burma	72	— 2	·725	—·052	3·8	+0·5
Assam	80	— 5	·627	—·068	4·2	—1·7
Bengal	75	— 3	·746	—·059	3·4	—0·9
Bihar and Orissa	51	— 7	·523	—·085	2·2	+0·1
United Provinces	43	— 1	·401	—·060	2·2	+0·6
Punjab	54	+ 8	·396	—·020	3·7	+1·4
North-West Frontier Province.	58	— 1	·414	—·057	3·4	+0·3
Sind	64	+ 8	·621	+·048	2·1	+0·1
Rajputana	42	+10	·385	+·022	2·6	+0·7
Bombay	60	— 1	·614	—·032	2·6	+0·9
Central India	37	+ 2	·361	—·041	2·9	+1·1
Central Provinces	36	0	·388	—·042	2·0	+0·1
Hyderabad	49	— 3	·536	—·050	2·0	—0·7
Mysore	67	— 1	·606	—·035	2·9	—0·5
Madras	71	— 2	·818	—·031	3·1	—0·9

Rainfall.

13. The month's total rainfall was well above the average in the United Provinces West, the Punjab, Kashmir, Rajputana, Gujarat and Hyderabad North, and either normal or below it elsewhere. The largest excess occurred in the Punjab East and North (1½″) and Kashmir (0·9″); while the defect was most pronounced in Assam (2″), the Bay Islands (1·7″), Malabar (1·8″) and Madras South-east (1·1″).

TABLE 14.

SUB-DIVISION.	NUMBER OF RAINY DAYS.		RAINFALL.			
	Actual.	Normal.	Actual.	Normal.	Departure from normal.	Percentage departure from normal.
			"	"	"	
1. Bay Islands	0·5	2·9	0·09	1·83	—1·74	— 95
2. Lower Burma	1·6	2·0	0·92	1·50	—0·58	— 39
3. Upper Burma	3·3	2·3	1·26	1·15	+0·11	+ 10
4. Assam	10·5	12·0	7·23	9·32	—2·09	— 22
5. Bengal	3·7	4·2	3·12	3·08	+0·04	+ 1
6. Orissa	2·0	2·8	0·83	1·68	—0·85	— 51
7. Chota Nagpur	0·9	1·9	0·28	0·95	—0·67	— 71
8. Bihar	0·6	1·2	0·27	0·65	—0·38	— 58
9. United Provinces, East	0·5	0·5	0·13	0·20	—0·07	— 35
10. Do. do., West	2·6	0·7	0·96	0·28	+0·68	+243
11. Punjab, East and North	4·5	1·1	2·13	0·50	+1·63	+326
12. Punjab, South-west	2·6	1·1	0·96	0·44	+0·52	+118
13. Kashmir	7·7	5·0	3·91	3·05	+0·86	+28
14. North-West Frontier Province	2·5	3·3	0·89	1·60	—0·71	— 44
15. Baluchistan	0·6	1·5	0·15	0·51	—0·36	— 71
16. Sind	0·4	0·3	0·12	0·11	+0·01	+ 9
17. Rajputana, West	1·6	0·6	0·51	0·22	+0·29	+132
18. Do., East	1·7	0·5	0·46	0·22	+0·24	+109
19. Gujarat	0·6	0·1	0·20	0·03	+0·17	+567
20. Central India, West	0·3	0·4	0·09	0·16	—0·07	— 44
21. Do., East	0·1	0·7	0·04	0·36	—0·32	— 89
22. Berar	0·4	0·7	0·16	0·25	—0·09	— 36
23. Central Provinces, West	0·5	0·8	0·17	0·36	—0·19	— 53
24. Do., East	1·2	1·9	0·44	0·98	—0·54	— 55
25. Konkan	0·1	0·7	0·08	0·40	—0·32	— 80
26. Bombay Deccan	0·7	1·4	0·32	0·70	—0·38	— 54
27. Hyderabad, North	1·6	1·3	0·69	0·54	+0·15	+ 28
28. Do., South	1·9	1·8	0·88	0·84	+0·04	+ 5
29. Mysore	1·5	2·3	0·73	1·56	—0·83	— 53
30. Malabar	1·4	3·9	0·84	2·67	—1·83	— 69
31. Madras, South-east	0·7	2·3	0·35	1·46	—1·11	— 76
32. Do., Deccan	0·7	1·4	0·24	0·69	—0·45	— 65
33. Do. Coast, North	1·7	1·6	0·97	0·97	0	0

TABLE 15.

DIVISION.	RAINFALL.			
	Actual.	Normal.	Departure from normal.	Percentage departure from normal.
	"	"	"	
Burma	1·13	1·29	—0·16	— 12
Assam	7·23	9·32	—2·09	— 22
Bengal	3·12	3·08	+0·04	+ 1
Bihar and Orissa	0·41	0·98	—0·57	— 58
United Provinces	0·59	0·25	+0·34	+136
Punjab	1·84	0·49	+1·35	+276
North-West Frontier Province	0·89	1·60	—0·71	— 44
Sind	0·12	0·11	+0·01	+ 9
Rajputana	0·47	0·22	+0·25	+114
Bombay	0·24	0·43	—0·19	— 44
Central India	0·07	0·26	—0·19	— 73
Central Provinces	0·28	0·57	—0·29	— 51
Hyderabad	0·78	0·68	+0·10	+ 15
Mysore	0·73	1·56	—0·83	— 53
Madras	0·56	1·34	—0·78	— 58
Mean of India	1·02	1·14	—0·12	— 11

Snowfall.

I.—AFGHANISTAN.

14. No snowfall information has been received, but much rain is reported to have fallen during the third week in Khorasan and the Kabul district.

II.—NORTH-WEST FRONTIER PROVINCE.

(*a*) *Kohat.*—No snow fell on the Samana range.

(*b*) *Hazara.*—The statement below shows the character of snowfall in this area during the first fifteen days of the month :—

TABLE 16.

Locality.	Total number of falls.	Total depth of snowfall.		Depth of accumulation on the 15th April.	
		Ft.	In.	Ft.	In.
Narang	2	0	8	1	2
Paludran	2	0	3	...	
Kagan	2	0	3	...	
Sundigali	2	1	1	...	
Jachha	2	0	4	...	
Thandiani	3	0	7	0	9
Dungagali	2	0	1½	...	

The snow line is reported to have come down to 5,000 feet on the 10th. At the end of the period there was but little snow lying on the lower elevations, but the higher pass had still a thick covering and were closed to traffic.

III.—KASHMIR.

(*a*) *Srinagar.*—Snowstorms occurred on the big mountains to the east on the 10th and 21st.

(*b*) *Skardu.*—Moderate or heavy snow fell on the higher ranges around the station on the 10th, 19th to 21st and 27th.

(*c*) *Dras.*—Snow fell at Dras on the 5th, 10th, 11th, 18th to 22nd, 27th and 28th to a total depth of about 1 foot.

(*d*) *Kargil.*—Light snow fell on the surrounding hills on the 10th, 11th and daily from the 18th to the 21st; the snow line descended to a considerable distance from the top. Accumulations at the end of the month varied between 1 inch and 1 foot.

IV.—PUNJAB.

(*a*) *Kangra.*—There was unusually heavy snowfall and on the 28th the snow line came down to a level of about 6,000 feet.

(*b*) *Kilba (Simla Hills).*—Snowstorms of feeble intensity occurred on fourteen days on the adjoining hills.

The snow line came down to 7,000 feet on the 20th and 21st.

TABLE 17.

Name of pass.	DEPTH OF ACCUMULATION AT THE END OF THE MONTH.	
	Reported.	Normal.
	Feet.	Feet.
Rupin Pass	7	10
Brua	8	9½
Shatul	9	7½
Harang	1	2

V.—UNITED PROVINCES.

(*a*) *Garhwal.*—Snow to a total depth of about 2 feet fell on the mountains in the north of the district; the lowest level reached by the snow line was 7,000 feet.

(*b*) *Almora.*—The total fall of the month was estimated at 8′ in Byans, 7½′ in Malla Danpur and Darma, 4′ in Chaudas and 1½′ in Malla Johar. The lowest descent of the snow line below the perpetual snows was to a distance of 8 miles in Byans.

TABLE 18.

Name of pass or peak.	Depth of accumulation at the end of the month.	
	Reported.	Normal.
	Feet.	Feet.
Nuwe Pass	15	26¼
Binkaru „	10	17⅔
Lampia „	11	13⅔
Lipulekh „	8	12⅔
Kaphini Peak	7½	2½
Millamdhura	¼	4½
Baghdwar	⅙	...

VI.—SIKKIM.

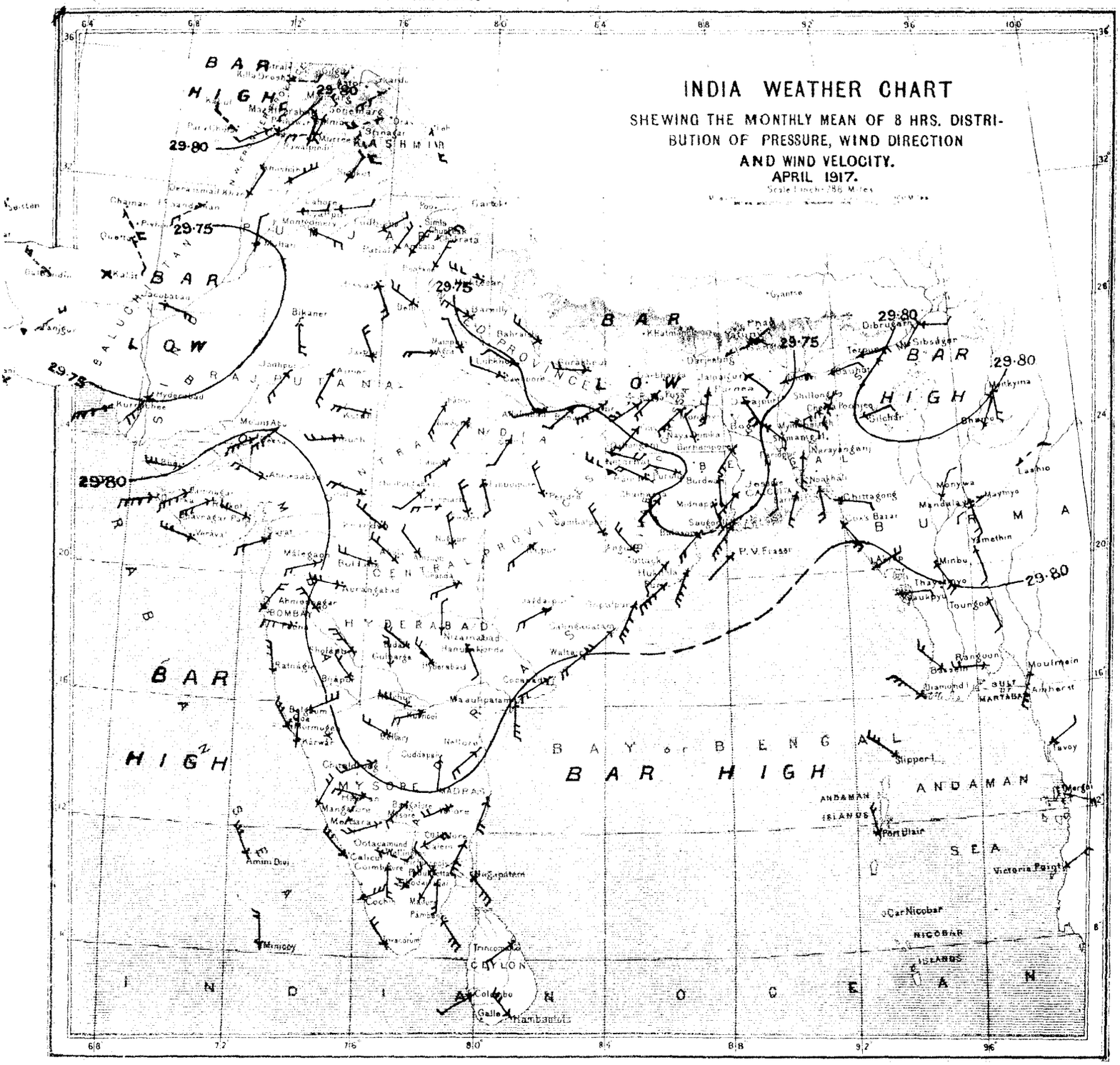
(*a*) *Gangtok.*—No snow fell.

(*b*) *Yatung.*—The total fall of the month measured about 2 feet in depth.

SUMMARY.

15. There is little or no information for Afghanistan and the North-West Frontier Province, but in the western Himalayas the falls were unusually frequent and in places heavy. Snow is reported to have fallen as low as 5,000 feet in the Hazara hills and 6,000 feet in Kulu. The accumulations at the end of the month were materially greater than usual in the Kulu hills and on the higher elevations in Hazara, and normal or below it elsewhere.

HEM RAJ.

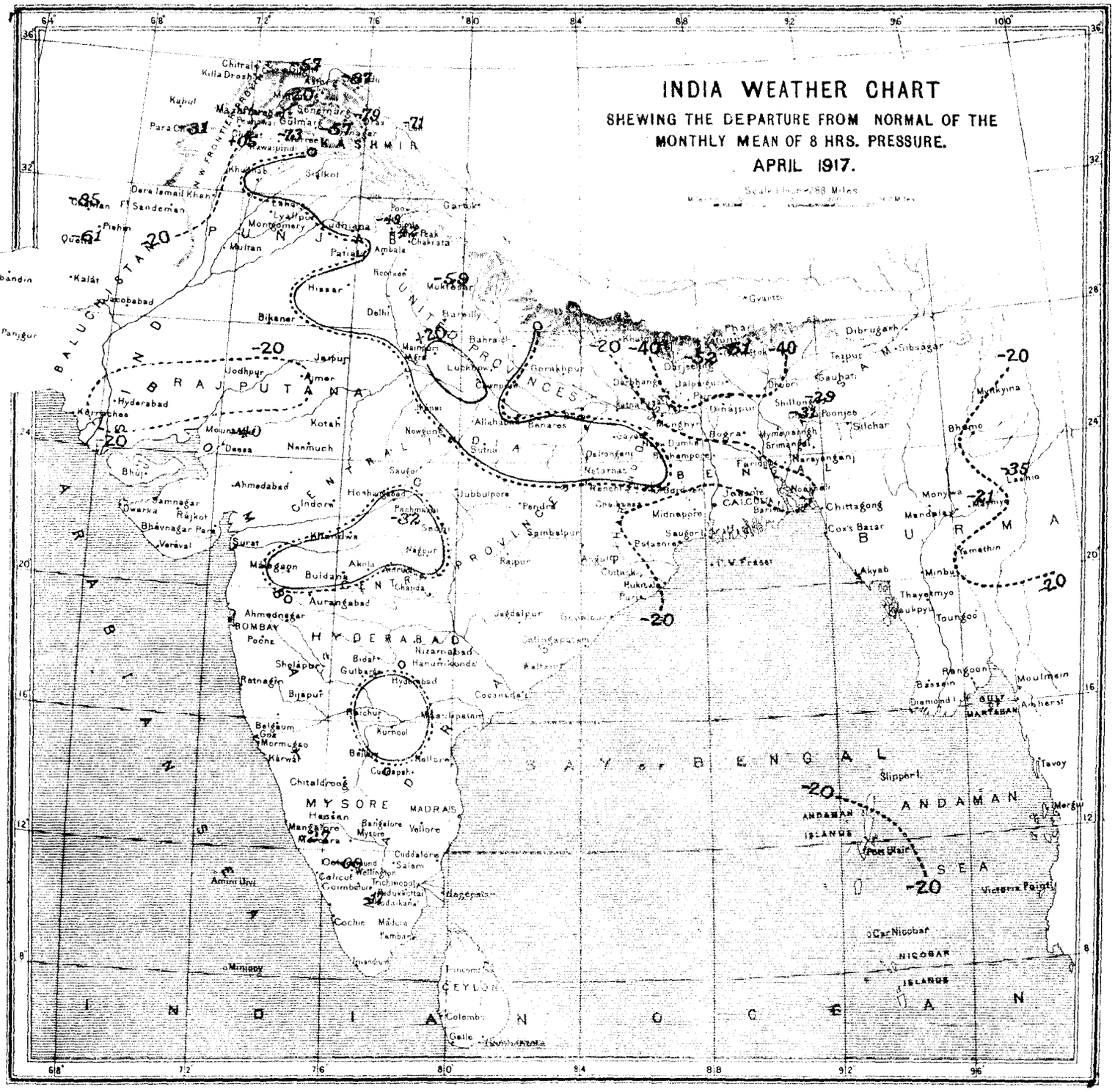


The lines of the above chart represent isobars or lines of equal barometric pressure, the numbers attached indicating the barometric pressure in inches and being drawn for differences of pressure of ·05 inch. The isobars in the Bay of Bengal are filled in by means of the shore observations, and by comparison with the normal distribution of pressure.

The mean 8 hrs. wind directions of the month are shewn by means of arrows flying with the wind, and are calculated by means of Lambert's formula applied to the winds as given in Table B of the 8 hrs. observations. The mean wind directions for the hill stations are indicated by broken arrows to distinguish them from the wind arrows for the plain stations. The mean velocity of the winds during the month is shewn by the following notation:—

Velocity of	0 to 2	miles	per	hour	...	one	feather	added	to	the	wind arrow.
,, ,,	2 to 5	,,	,,	,,	...	two	feathers	,,	,,	,,	,,
,, ,,	5 to 10	,,	,,	,,	...	three	,,	,,	,,	,,	,,
,, ,,	10 to 20	,,	,,	,,	...	four	,,	,,	,,	,,	,,
	over 20	,,	,,	,,	...	five	,,	,,	,,	,,	,,

Wind strengths are based on factor 2·2 for the standard type of Beckley Robinson anemograph, instead of 3·0 as used for this plate up to December 1911 inclusive.



The chart shows the departure from normal of the mean during the month of 8 hrs. pressure by means of lines drawn for equal amounts of departure. The numbers are given in thousandths of an inch, 20 representing ·020″ or two hundredths of an inch, &c. Continuous lines indicate that the pressure was in excess by amounts indicated by the numbers attached to the lines, and broken or dotted lines that it was in defect by amounts indicated by the numbers attached to the lines. Two parallel lines near to each other, one continuous and the other broken or dotted, represent the line of no departure, the dotted line facing the area of deficient pressure or negative departures.

CHART SHEWING THE DEPARTURE FROM NORMAL
OF THE MONTHLY MEAN OF DAILY
MAXIMUM TEMPERATURE.

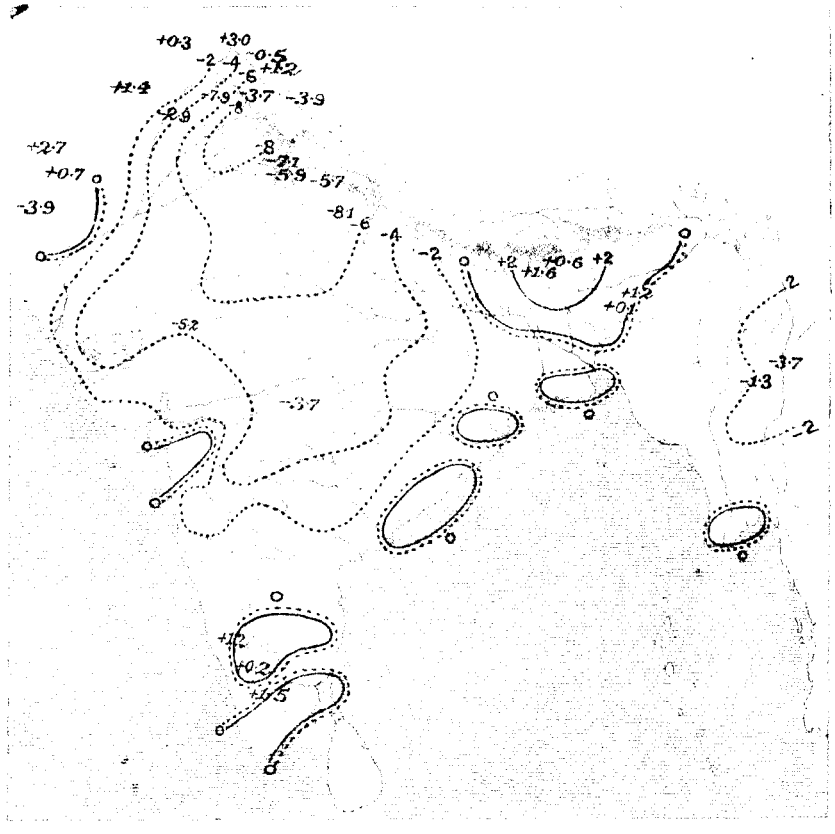


CHART SHEWING THE DEPARTURE FROM NORMAL
OF THE MONTHLY MEAN OF DAILY
MINIMUM TEMPERATURE.

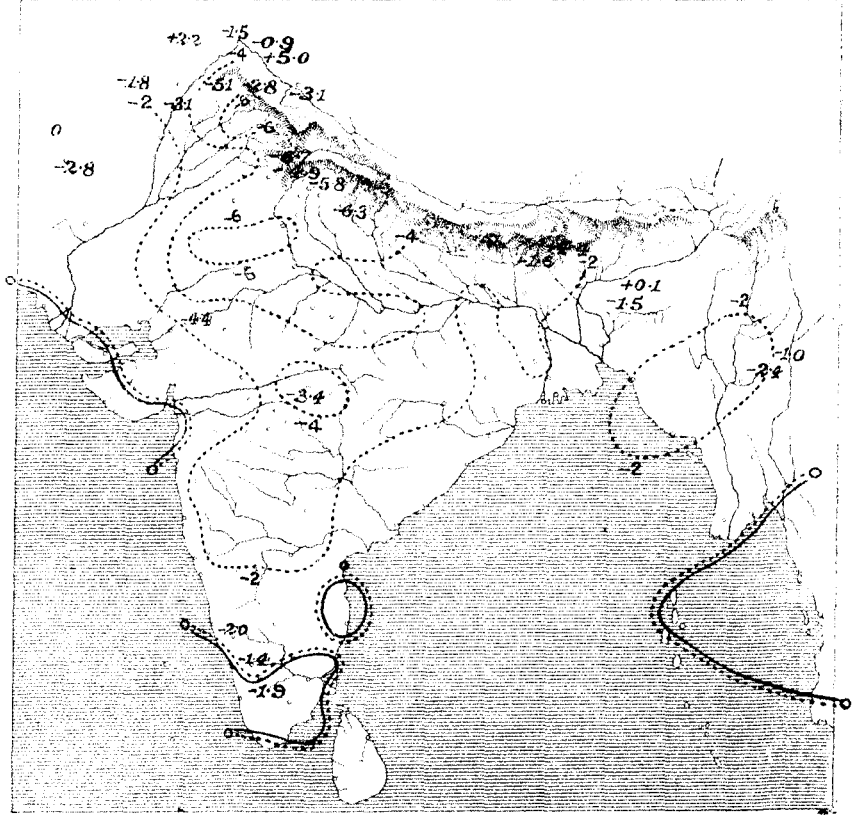


CHART SHEWING THE DEPARTURE FROM NORMAL
OF THE MONTHLY MEAN OF DAILY
MEAN TEMPERATURE.

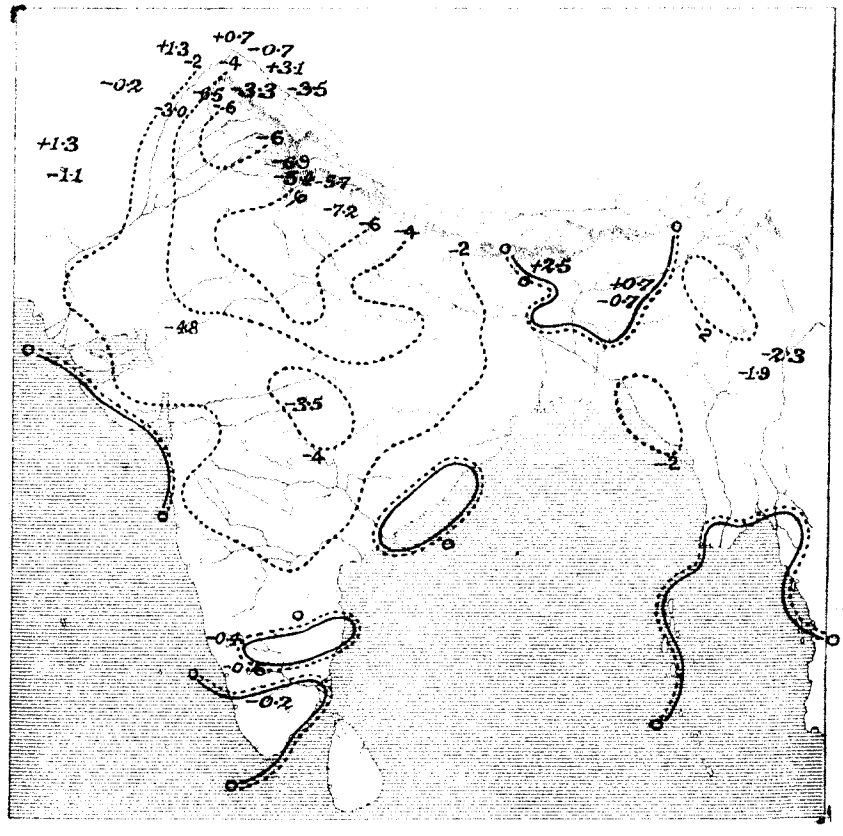


CHART SHEWING THE DEPARTURE FROM NORMAL
OF THE MONTHLY MEAN OF ABSOLUTE
HUMIDITY AT 8 HRS.

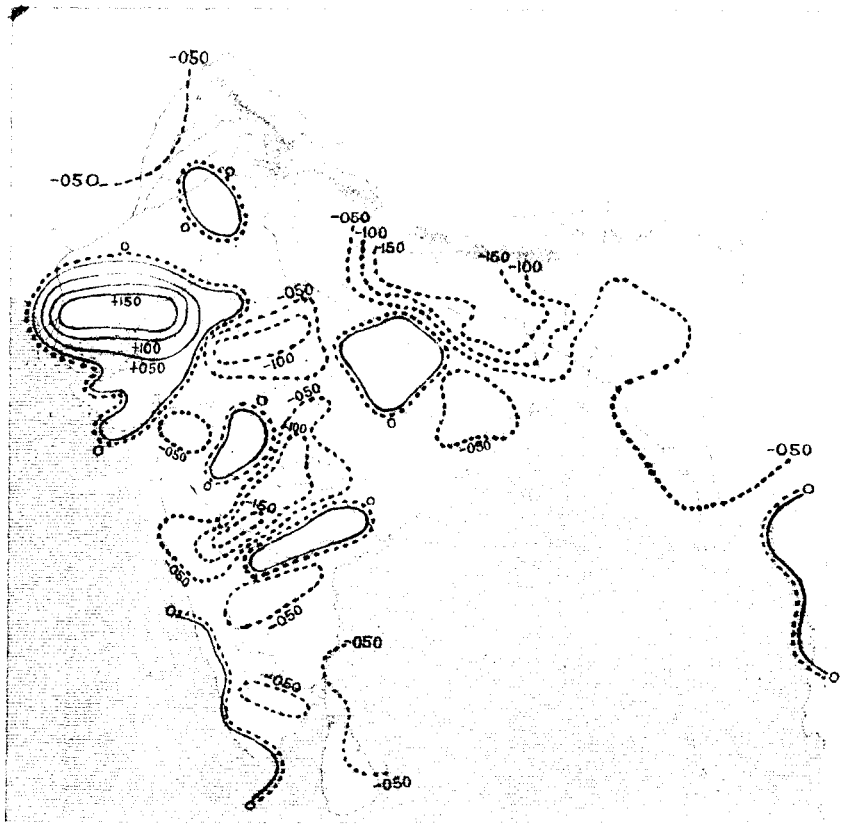


CHART SHEWING THE DEPARTURE FROM NORMAL
OF THE MONTHLY MEAN OF RELATIVE
HUMIDITY AT 8 HRS.

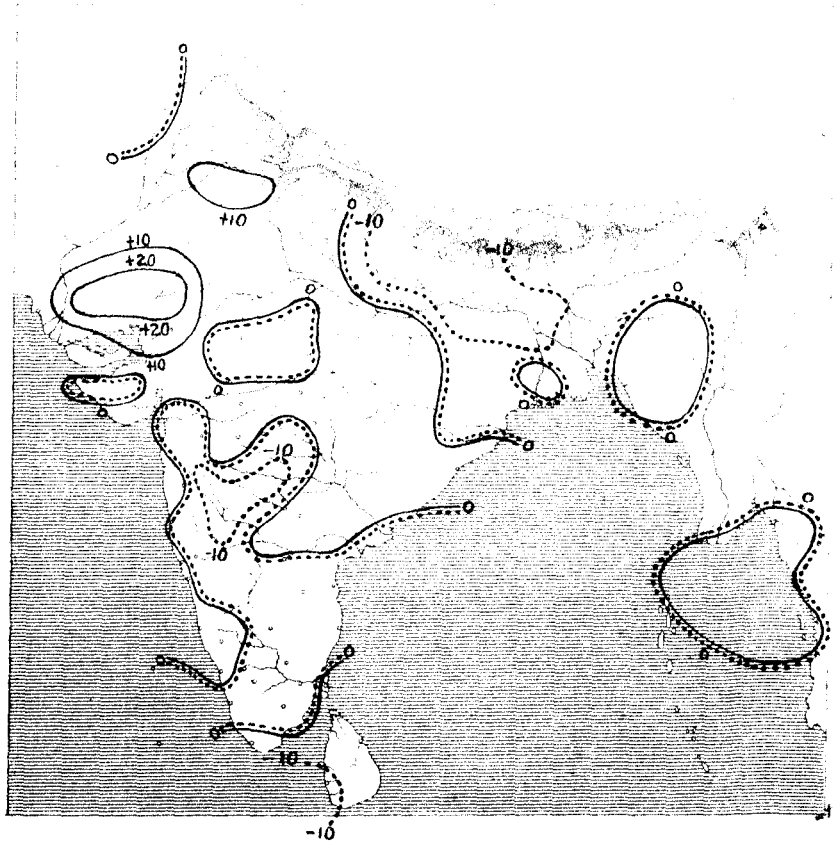


CHART SHEWING THE DEPARTURE FROM NORMAL
OF THE MONTHLY MEAN OF CLOUD
AMOUNT AT 8 HRS.

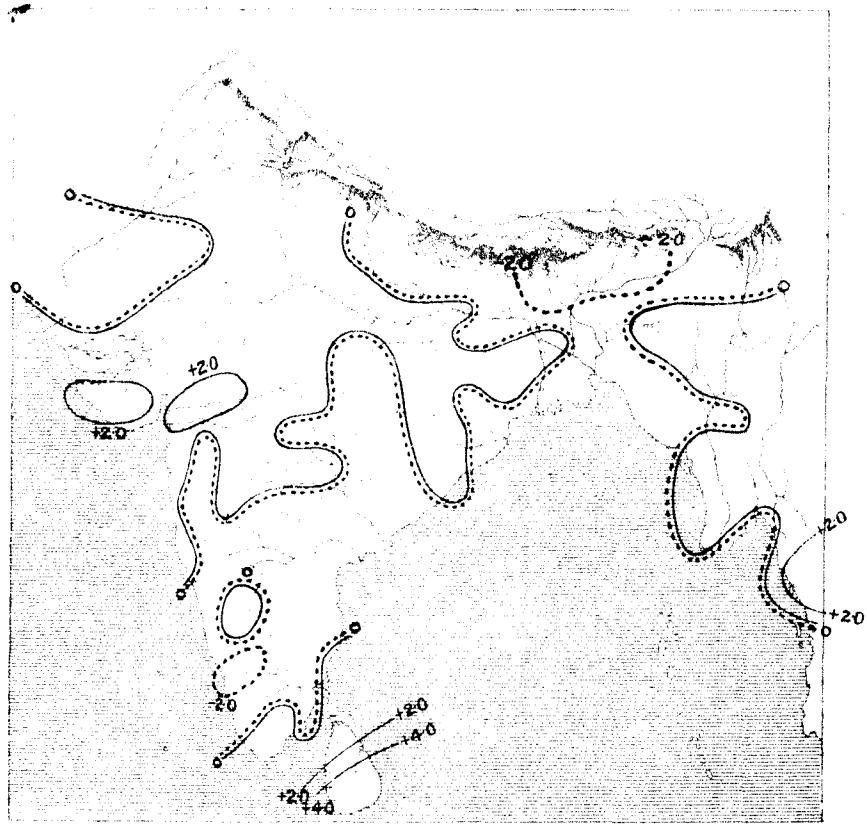
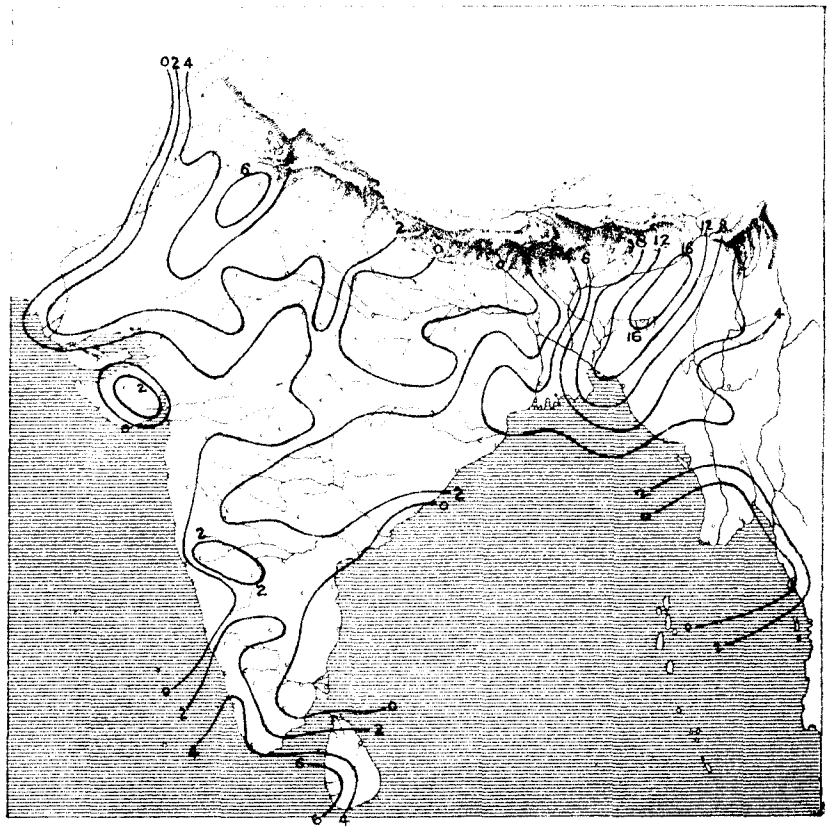
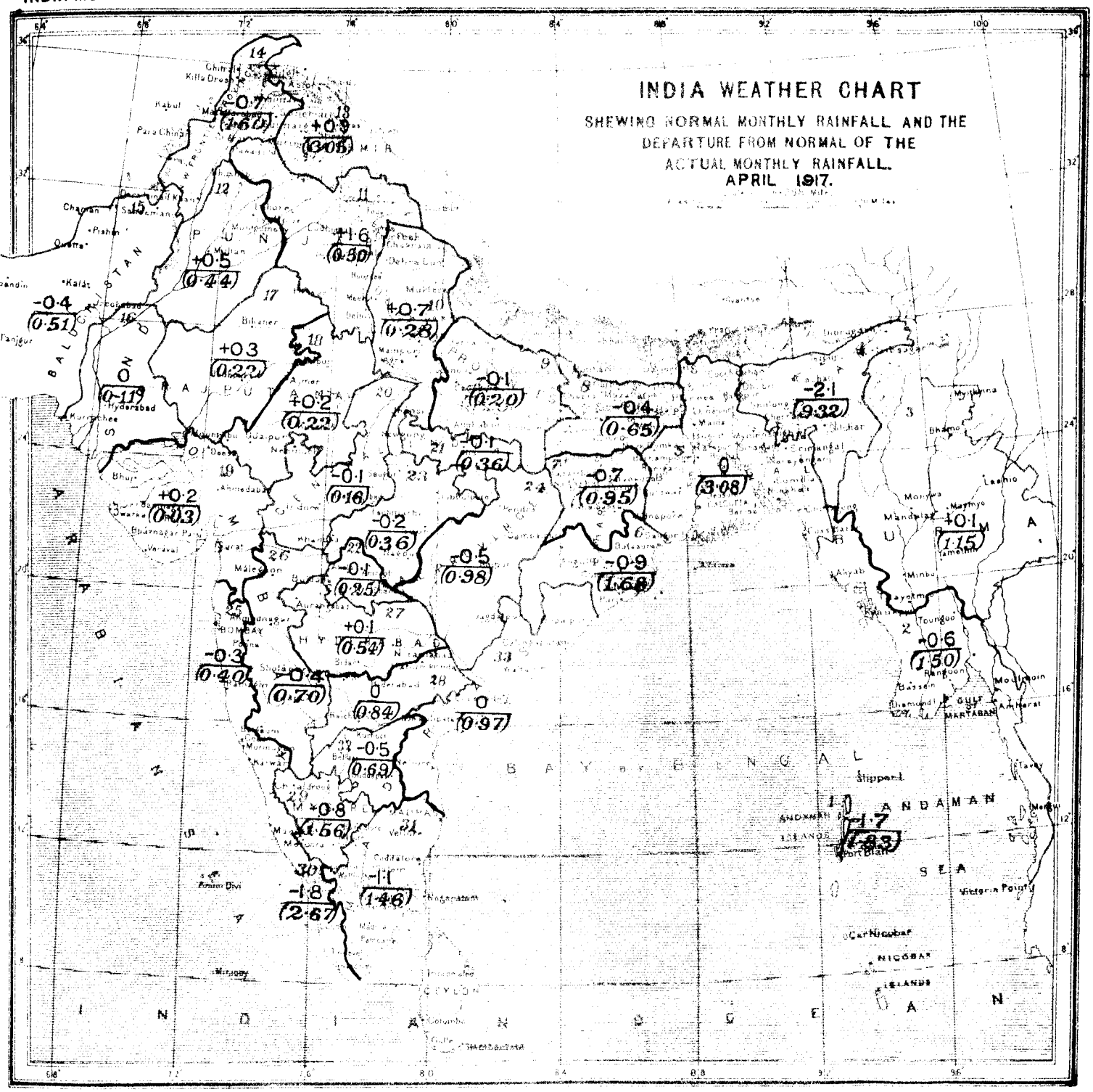


CHART SHEWING THE TOTAL NUMBER OF DAYS IN THE
MONTH ON WHICH RAINFALL EQUALLED OR
EXCEEDED 0·10 INCH.
(BASED ON THE RETURNS OF TABLE B.)





The country is divided into 33 areas as shewn in the list below. The numbers in that list correspond with the red numbers on the chart, and serve to identify the areas. The numbers in brackets on the chart give the average over the divisions of the normal monthly rainfall, the numbers above these give the departures from normal of the average actual rainfall over the divisions.

1. Bay Islands
2. Lower Burma
3. Upper Burma
4. Assam
5. Bengal
6. Orissa
7. Chota Nagpur
8. Bihar
9. United Provinces, East
10. United Provinces, West
11. Punjab, East and North
12. Do., Southwest
13. Kashmir
14. Northwest Frontier Province
15. Baluchistan
16. Sind
17. Rajputana, West
18. Rajputana, East
19. Gujarat
20. Central India, West
21. Do., East
22. Berar
23. Central Provinces, West
24. Do., East
25. Konkan
26. Bombay, Deccan
27. Hyderabad, North
28. Hyderabad, South
29. Mysore
30. Malabar
31. Madras, Southeast
32. Madras, Deccan
33. Madras Coast, North

GOVERNMENT OF INDIA

METEOROLOGICAL DEPARTMENT

MONTHLY WEATHER REVIEW

PUBLISHED BY ORDER OF

THE GOVERNMENT OF INDIA.

CALCUTTA, MAY, 1917.

INTRODUCTION.

THIS review of the weather in India during the month of May, 1917, is based on observations taken daily at 8 hrs. at 217 stations, and on additional observations taken at 10 hrs. and 16 hrs. at 11 stations. In the rainfall summary have been utilized the data furnished by the meteorological observatories, and the rainfall statements of the month published by the Provincial Governments.

The brief notes on solar, magnetic and seismic disturbances are supplied by the chief observatories in the Indian area.

For a statement of the methods adopted in recording and tabulating the data, for each of the elements of observation, reference should be made to the introductory portion of the review for January.

Summary of the chief features of the weather in India during the month.

2. Weather was unusually disturbed, and the month's rainfall exceeded the normal in all the divisions with the exception of Burma, Assam, Bengal and Mysore.

Of the other climatic elements, cloud was markedly in excess over north-west India generally, the United Provinces, Central India and the Central Provinces, and was distinctly less than usual in Assam, Bengal, Mysore and the greater part of Madras; while humidity was decidedly high in most parts of the area of heavy cloud as well as in Hyderabad, and was low in Mysore. Temperature was nearly normal in Burma, Assam, Bengal, Baluchistan, Mysore and Madras, 4° higher than usual in Kashmir and more or less below the average elsewhere. It was below normal by 4° in Bihar and Orissa and Gujarat, by 6° in Hyderabad, by 7° in the United Provinces and the Punjab, by 9° in Central India and the Central Provinces and by 11° in Rajputana.

Barometric pressure averaged over the plains was higher than usual by ·055".

Solar, magnetic and seismic disturbances.

KODAIKANAL OBSERVATORY.

3. *Solar Observations.*—The sun was examined for spots and faculae on all the days during the month. Prominences could not be observed on one day.

Sunspots.—Thirty new groups of spots were observed as against twenty-six in April. The daily average number was 6·7 and the average life of a spot 7·2 days, the averages for the preceding month being 5·1 and 6·8 respectively. The distribution of the spots in latitude was as follows :—

TABLE 1.

—	0°—10°	11°—20°	21°—30°	Mean latitude.	Extreme latitudes.
North . . .	7	9	1	13°·4	5° & 23
South . . .	2	7	4	17°·0	5° & 26°

Prominences.—One hundred and twenty-two large, one eruptive and nine metallic prominences were recorded. The highest was 180″ and was observed on the 30th at latitude +82° west.

Magnetic disturbances.—"Moderate" disturbances were recorded on the following dates:—1 to 4, 16 and 17 and 25.

J. EVERSHED,
Director,
Kodaikanal and Madras Observatories.

Seismic records.

$\phi = 10° 13' 50''$ N ; $\lambda = 77° 28' 00''$ E ; $h = 2343$ m.
Subsoil Rock.

Apparatus.—Milne's Horizontal Pendulum Seismograph.

TABLE 2.

	V	To	ϵ	$\frac{r}{To^2}$
AN:				
AE:	9·76	17·0	1	2·7
AZ:				

Date.	Phase.	Time, G. M. T.	Period (Sec.).	Amplitude (u). An.	Ae.	Az.	Distance △ (Km.).	Remarks.
1917.		h. m. s.						
May 1st & 2nd.	e P	18 40 42	...	...	...	...	...	
	i L	18 54 24	...	...	...	...	...	
	M	19 34 06	...	...	1420	...	...	
	F	0 02 30	...	...	...	...	...	
„ 24th	e P	20 16 12	...	...	...	...	...	
	e L	20 21 18	...	...	...	...	...	
	M	20 30 30	...	...	70	...	...	
	F	20 42 48	...	...	...	...	...	
„ 29th	e P	6 59 12	...	...	...	...	...	
	e L	7 00 18	...	...	50	...	...	
	M	7 06 24	...	...	...	...	...	
	F	7 17 12	...	...	...	...	...	
„ 31st	e P	9 06 24	...	...	...	...	...	
	i L	9 38 12	...	...	...	...	...	
	M	9 50 48	...	...	620	...	...	
	F	11 52 36	...	...	...	...	...	Driving clock removed for repairs May 5th, 1919.

T. ROYDS,
Assistant Director.

BOMBAY OBSERVATORY.

Alibag magnetic record.

4. During the month of May 1917 the traces showed 10 calm days, and 21 days of small disturbance.

The days of the month selected as "quiet" for the purposes of the Magnetic Survey of India are the 6th, 8th, 12th, 20th and 31st.

The following table represents the magnetic character of each day during the month.

TABLE 3.

Day.	Character.	Day.	Character.	Day.	Character.	Day.	Character.
1	S	9	C	17	S	25	S
2	S	10	S	18	C	26	S
3	S	11	S	19	C	27	S
4	S	12	C	20	C	28	S
5	S	13	C	21	S	29	S
6	C	14	C	22	S	30	S
7	S	15	S	23	S	31	C
8	C	16	S	24	S		

C = calm; S = small; M = moderate; G = great; V. G. = very great.

The mean observed absolute values of the several magnetic elements reduced to the mean monthly tabulations of the magnetograms, as also the ranges and the summed ranges of the horizontal force and the declination for the month are as follows:—

Easterly declination	0° 33′ 2″.
Horizontal force	0·36879 C. G. S. unit.
Vertical force	0·16868 C. G. S. unit.
Inclination	24° 34′·7.
Horizontal force range	0·00954 C. G. S. unit.
Horizontal force summed range	0·00393 C. G. S. unit.
Declination range	4′·6.
Declination summed range	19′·7.

(NOTE.—Summed range means sum without regard to sign of twenty-four ordinates of the diurnal inequality.)

Seismic records.

$\phi = 18° 53' 36''$N; $\lambda = 72° 48' 56''$E; $h = 11$m. *Subsoil Trap.*

Apparatus.—Milne's Horizontal Pendulum Seismograph.

TABLE 4.

	V	To	ϵ	$\frac{r}{To^2}$
AN:				
AE:	9	21	1	
AZ:				

Date.	Phase.	Time, G. M. T.	Period (Sec.)	Amplitude (u). An.	Ae.	Az.	Distance △ (Km.).	Remarks.
1917.		h. m. s.						
May 1st	P	18 42 8	...	...	...	...	...	
	M	19 35 36	...	...	1600	...	...	
	F	...	...	...	...	...	...	End mixed in tremors.
„ 2nd	P	...	...	...	...	...	...	Beginning mixed in tremors.
	M	2 31 49	...	...	44	...	...	
	F	2 41 49	...	...	...	...	...	
„ 4th	P	...	...	...	...	...	...	Beginning mixed in tremors.
	M	1 54 7	...	...	122	...	...	
	F	2 18 45	...	...	...	...	...	
„ 8th	...	19 43	...	...	...	...	...	Thickening of line.
„ 9th	P	*16 6 13	...	...	...	...	...	
	S	16 14 45	...	...	...	...	...	
	M	16 43 11	...	...	111	...	...	
	F	...	...	...	...	...	...	End mixed in tremors.
„ 16th	...	14 19	...	...	...	...	...	Thickening of line.
„ 29th	...	4 1	...	...	...	...	...	Do. do.
„ 31st	P	9 7 27	...	...	...	...	...	
	M	9 51 27	...	...	722	...	...	
	F	11 41 58	...	...	...	...	...	

Sensibility to tilt 1 mm. of amplitude on the trace = 0·32″.

* This value is as shown by the float record.

N. A. F. MOOS,

Director,

Bombay and Alibag Observatories.

5. CALCUTTA (ALIPORE) OBSERVATORY.

Seismic records.

$\phi = 22° 32'$ N; $\lambda = 88° 20'$ E; $h = 6{\cdot}4$m. *Subsoil Alluvial.*

Apparatus.—*Two Omori Ewing Horizontal Pendulum Seismographs.*

TABLE 5.

	V	To	ϵ	$\frac{r}{To^2}$
AN:	29	18	1	
AE:	29	42	1	
AZ:				

Date.	Phase.	Time, G. M. T.	Period (Sec.).	Amplitude (u). An.	Ae.	Az.	Distance △ (Km.)	Remarks.
1917		h. m. s.						
May 1st	P	18 43 42	4	...	...	...	...	The waves are of long period and give resonance in the seismograph pendulums. It has therefore only been possible to determine the initial stage with accuracy. * The tracing pen becoming too short could not trace the full maximum displacement, hence approximate amplitude measuring one side from the mean position is given.
	S	18 51 30	7	...	...	...	...	
	L	18 54 30	19	...	...	...	...	
	M	19 41 3	...	* 2620 ?	...	...	...	
	F	21 10 42	...	...	...	...	...	
May 9th	P	16 4 24	4	...	...	...	...	
	S	16 11 42	6	...	...	...	...	
	L	16 21 30	17	...	...	...	...	
	M	16 24 42	...	798	379	...	...	
	F	16 53 00	...	...	...	...	...	
	P	21 49 30	2	...	...	...	...	
	S	21 51 54	4	...	...	...	...	
	L	21 53 48	?	...	...	...	...	
	M	21 55 2	...	207	...	...	...	
	F	22 28 00	...	...	...	...	...	
„ 31st	P	9 0 2	6	...	...	...	...	
	S	9 10 4	15	...	...	...	...	
	L	9 34 7	19	...	...	...	...	
	M	9 41 3	...	1276	...	...	...	
	F	10 17 2	...	...	...	...	...	

Lines overlapping trace not measurable.

6.—SIMLA OBSERVATORY.

Seismic records.

$\phi = 31° 6' 00''$ N; $\lambda = 77° 11' 00''$ E; $h = 2433{\cdot}5$m.

Subsoil Rock.

Apparatus.—Two Omori Ewing Horizontal Pendulum Seismographs (Masses 50 Kg.)

TABLE 6.

	V	To	ϵ	$\frac{r}{To^2}$
AN:	14	45	1	
AE:	14	45	1	
AZ:				

Date.	Phase.	Time, G. M. T.	Period (Sec.).	Amplitude (u). An.	Ae.	Az.	Distance △ (Km.).	Remarks.
1916.		h. m. s.						
Feb. 1st	P	7 45 06	...	...	...	...	...	
	S	7 51 30	...	...	...	...	...	
	L	8 00 12	...	...	...	...	...	On instrument recording North-South oscillations.
	L	8 02 06	...	...	...	...	...	On instrument recording East-West oscillations.
	M_1	8 02 18	... 42	2243	..	...	...	
	M_2	8 05 06		...	1993	...	...	
	F	9 23 48	...	...	...	...	...	
„ 1st	i	16 24 48	...	...	...	...	...	
	F	16 26 24	...	...	...	...	...	Very slight tremors.
„ 2nd	e	21 42 54	...	...	...	...	...	
	F	22 03 00	...	...	...	...	...	Very slight tremors.
„ 6th	e	11 01 36	...	...	...	...	...	
	F	12 14 12	...	...	...	...	...	Slight tremors.
6th	Pe	22 03 24	...	...	...	...	...	
	Se	22 12 30	...	...	...	...	...	
	L	22 28 36	...	...	...	...	...	
	M_1	22 30 36	... 30	243	432	...	...	
	M_2	22 35 42		468	343	...	...	
	F	23 36 24	...	...	...	...	...	
Feb. 10th	e	2 08 36	...	...	...	...	...	
	L	2 16 18	...	...	...	...	...	
	M	2 17 00	30	118	36	...	...	
	F	2 35 48	...	...	...	...	...	
„ 14th	e	10 18 30	...	...	...	...	...	
	F	10 57 18	...	...	...	...	...	Slight tremors.
„ 14th	e	17 56 30	...	...	...	...	...	
	M	18 03 18	24	43	43	...	...	
	F	18 37 18	...	...	...	...	...	
„ 15th	e	11 58 18	...	...	...	...	...	
	M_1	12 26 00	... 24	...	22	...	...	
	M_2	12 27 12	...	71	...	...	...	
	F	12 56 48	..	...	...	...	...	
„ 20th	e	18 09 48	...	...	...	...	...	
	M	18 36 48	18	114	79	...	...	
	F	19 24 54	...	...	...	...	...	
„ 21st	i	8 59 30	...	...	...	...	...	
	F	9 01 06	...	...	...	...	...	Very slight shock.
„ 21st	e	14 10 42	...	...	...	...	...	
	F	14 36 18	...	...	...	...	...	Slight tremors.
„ 27th	Pe	20 43 18	...	...	...	...	...	
	S	21 07 18	...	...	...	...	...	
	L	21 28 36	...	...	...	...	...	
	M	21 34 12	30	464	300	...	...	
	F	23 17 12	...	...	...	...	...	
„ 28th	e	13 20 54	...	...	...	...	...	
	F	13 31 42	...	...	...	...	...	Slight shock.
„ 28th	e	18 59 18	...	...	...	...	...	
	F	19 08 42	...	...	...	...	...	Slight shock.
March 7th	e	13 52 54	...	...	...	...	...	
	F	14 06 06	...	...	...	...	...	Very slight tremors.
„ 10th	i	4 55 06	...	...	...	...	...	
	F	4 55 48	...	...	...	...	...	Very slight local shock.
„ 14th	i	11 25 18	...	...	...	...	...	
	F	11 30 12	...	...	...	...	...	Very slight local shock.
„ 18th	e	1 12 30	...	...	..	...	...	
	F	1 34 42	...	...	...	...	...	Very slight tremors.

Date.	Phase.	Time, G. M. T.	Period (Sec.)	Amplitude (μ). An.	Ae.	Az.	Distance Δ (Km.)	Remarks.
1916.		h. m. s.						
Mar. 19th	e	22 19 00	...	...	...	...	...	
	F	22 40 18	...	...	...	...	...	Very slight tremors.
„ 26th	i	0 00 12	...	...	...	...	...	
	M	0 17 24	...	43	...	...	...	
	M_2	0 19 00	19 ...	...	29	...	...	
	F	1 00 54	...	...	...	...	...	
„ 29th	i	2 09 48	...	...	...	...	...	
	M	2 10 48	18	29	...	...	...	
	F	2 26 18	...	...	...	...	...	
April 3rd	e	10 48 30	...	...	...	...	...	
	F	11 07 30	...	...	...	...	...	Slight tremors.
„ 3rd	e	11 34 00	...	...	...	...	...	
	F	11 34 24	...	...	...	...	...	Very slight local shock.
„ 5th	e	21 15 54	...	...	...	...	...	
	M	21 31 12	20	14	...	...	...	
	F	21 59 54	...	...	...	...	...	Slight tremors.
„ 7th	Pi	9 36 54	...	...	–	...	...	
	S	9 45 48	...	...	...	...	...	
	Le	9 54 48	...	...	...	...	...	
	M_1	9 55 06	...	...	421	...	...	
	M_2	9 58 42	26 ...	921	...	...	...	
	F	11 34 00	...	...	...	...	...	
„ 9th	e	19 24 00	...	...	...	...	...	
	M	19 33 18	18	14	...	...	...	
	F	19 39 36	...	...	...	...	...	Slight tremors.
„ 9th	e	23 19 54	...	...	...	...	...	
	F	23 22 06	...	...	...	...	...	Very slight local shock.
„ 15th	i	9 33 42	...	...	...	...	...	
	F	9 37 42	...	...	...	...	...	Slight tremors.
„ 15th	P	12 39 42	...	...	...	...	...	
	S	12 46 12	...	...	...	...	...	
	Le	12 58 18	...	...	...	...	...	
	M_1	12 58 48	...	150	79	...	...	
	M_2	13 04 42	24 ...	...	107	...	...	
	F	13 51 30	...	...	...	...	...	
15th	i	15 08 48	...	...	...	...	...	
	M	15 14 48	...	71	...	...	...	
	F	15 49 12	...	...	...	...	...	Slight shock.

Date.	Phase.	Time, G. M. T.	Period (Sec.)	Amplitude (μ). An.	Ae.	Az.	Distance Δ (Km.)	Remarks.
1916.		h. m. s.						
April 18th	P	4 13 30	...	...	...	...	...	
	S	4 23 06	...	...	...	...	...	
	L	4 40 30	...	...	...	...	...	
	M	4 41 48	30	114	285	...	...	
	F	5 07 54	...	...	...	...	...	
„ 21st	P	11 41 00	...	...	...	...	...	
	S	11 48 18	...	...	...	...	...	
	L	11 58 42	...	...	...	...	...	
	M_1	12 00 06	30 ...	>2143	...	...	...	Pendulum struck against stop on one side.
	M_2	12 02 42	...	...	250	...	...	
	F	12 53 30	...	...	...	...	...	
„ 21st	i	13 58 18	...	...	...	...	...	
	F	14 26 18	...	...	...	...	...	Slight shock.
„ 24th	P	8 24 00	...	...	...	...	...	
	S	8 48 12	...	...	...	...	...	
	L	9 12 54	...	...	...	...	...	
	M_1	9 18 12	27 ...	243	...	...	...	
	M_2	9 19 48	...	...	107	...	...	
	F	10 23 00	...	...	...	...	...	
„ 26th	e	3 23 36	...	...	...	...	...	
	M	3 37 54	24	43	29	...	...	
	F	4 19 06	...	...	...	...	...	
„ 30th	P	18 40 24	...	...	...	...	...	
	F	18 45 30	...	...	...	...	...	Very slight local shock.
May 8th	e	20 26 06	...	...	...	...	...	
	F	20 29 48	...	...	...	...	...	Slight tremors.
„ 9th	Pe	14 40 12	...	...	...	...	...	
	S	14 45 18	...	...	...	...	...	
	L	14 51 00	...	...	...	...	...	
	M_1	14 52 42	24 ...	71	...	...	...	
	M_2	14 57 24	...	...	29	...	...	
	F	15 42 48	...	...	...	...	...	
„ 17th	e	14 54 18	...	...	...	...	...	
	F	15 07 54	...	...	...	...	...	Slight shock.
„ 23rd	e	22 54 54	...	...	...	...	...	
	F	23 19 00	...	...	...	...	...	Slight tremors.
June 9th	e	21 40 42	...	...	...	...	...	
	F	22 07 06	...	...	...	...	...	Slight tremors.

Date.	Phase.	Time, G. M. T.	Period (Sec.).	Amplitude (u). An.	Ae.	Az.	Distance Δ (Km.).	Remarks.
1916.		h. m. s.						
June 15th	e	11 35 48	...	...	...	...	...	
	M	11 59 24	...	...	71	...	...	
	F	12 34 18	...	...	...	.	...	Tremors.
„ 15th	e	16 29 48	...	...	...	...	...	
	F	16 58 24	...	...	..	...	...	Very slight tremors.
„ 19th	e	4 00 54	...	...	...	...	...	
	F	4 27 24	...	...	...	...	...	Very slight tremors.
„ 21st	e	19 57 36	..	...	...	...	..	
	M	19 58 36	...	...	250	...	...	
	F	20 22 54	...	...	...	..	...	Local shock.
„ 21st	i	21 51 12	...	...	...	...	...	
	F	23 08 36	...	...	...	..	...	Tremors.
„ 24th	i	4 13 06	...	...	...	...	...	
	F	4 44 36	...	...	...	...	...	Slight tremors.
„ 30th	e	3 41 12	...	...	...	...	...	
	F	?	...	...	...	...	...	Slight tremors. End lost while changing sheet (4 h. 55 m. to 5 h. 5 m.)
July 16th	e	18 45 06	...	...	...	...	...	
	F	19 25 12	...	...	...	...	...	Slight tremors.
„ 27th	e	12 04 24	...	...	...	...	...	
	F	12 32 54	...	...	...	...	...	Slight tremors.
„ 30th	e	23 56 24	...	...	...	...	...	
	M	23 58 54	...	64	...	...	...	
Aug. 1st	F	0 19 30	...	...	...	...	...	Slight shock.
„ 3rd	P i	1 41 24	...	...	...	...	...	
	S	1 50 54	...	...	..	...	...	
	M	2 14 42	...	71	29	...	...	
	F	3 23 48	...	...	...	...	...	
„ 4th	i	8 05 48	...	...	...	...	...	
	F	8 06 06	...	...	...	...	...	Very slight local shock.
„ 8th	...	?	...	...	...	...	...	Beginning lost while changing sheet (4 h. 45 m to 4 h. 50 m.)
	F	5 16 06	...	...	...	...	...	Tremors.
„ 8th	i	19 06 42	...	...	...	...	...	
	F	19 29 12	...	...	...	...	...	Slight tremors.
„ 25th	e	10 17 06	...	...	...	...	...	
	F	10 47 06	...	...	...	...	...	Slight tremors.

Date.	Phase.	Time, G. M. T.	Period (Sec.).	Amplitude (u). An.	Ae.	Az.	Distance Δ (Km.)	Remarks.
1916.		h. m. s.						
Aug. 25th	e	10 59 42	...	...	...	...	...	
	M_1	11 10 54	...	71	...	...	...	
	M_2	11 14 18	..	...	36	...	...	
	F	11 43 06	...	...	...	...	...	Tremors.
„ 27th	i	22 59 06	...	...	...	...	...	
	F	23 29 06	...	..	...	...	...	Very slight tremors.
„ 28th	Pi	6 40 24	...	...	...	...	...	
	S	6 40 54	...	...	...	...	...	
	L	6 41 24	...	...	...	...	...	
	M	?	Very rapid.	>3500	...	...	...	
	F	9 08 18	...	...	...	...	...	The time of maximum was between 6 h. 41 m. 42 s. and 6 h. 42 m. 54 s. during which time the boom was striking at the stops. Very slight after shocks from 7 h. 13 m. 42 s. to 7 h. 15 m. 36 s. and from 8 h. 16 m. 24 s. to 8 h. 18 m. 0 s.
„ 28th	i	11 27 12	...	...	...	...	...	
	F	11 28 18	...	...	...	...	...	Very slight local shock.
„ 28th	e	11 41 00	...	...	...	...	...	
	F	11 42 18	...	..	...	...	...	Very slight local shock.
„ 29th	e	20 16 36	...	...	...	...	...	
	F	20 17 42	...	...	.	...	...	Very slight local shock.
Sept. 3rd	i	7 36 24	...	...	...	...	...	
	F	7 44 48	...	...	...	...	...	Very slight tremors.
„ 5th	i	22 37 36	...	...	...	...	...	
	F	22 58 42	...	...	...	...	...	Very slight tremors.
„ 11th	P	6 39 36	...	...	...	...	...	
	S	6 46 48	...	...	..	...	...	
	L	6 58 36	..	...	...	...	...	
	M	7 00 00	28	186	71	...	...	
	F	7 25 36	...	...	..	...	..	
„ 15th	P	7 10 18	...	...	...	...	...	
	S e	7 17 36	...	...	...	...	...	

Date.	Phase.	Time, G. M. T.	Period (Sec.)	Amplitude (μ). An.	Ae.	Az.	Distance Δ (Km.)	Remarks.
1916.		h. m. s.						
Sept. 15th	L	7 29 48	...	...	...	...	...	
	M_1	7 30 06	...	286	...	...	...	
	M_2	7 34 06	24 ...	...	107	...	...	
	F	8 27 18	...	...	...	...	...	
„ 16th	e	6 56 06	...	...	...	...	...	
	F	6 58 54	...	..	...	...	...	Very slight local shock.
„ 23rd	e	6 56 54	...	...	...	...	...	
	M	7 02 06	...	...	18	...	...	
	F	7 27 12	...	...	...	...	...	Slight tremors.
„ 23rd	e	7 37 06	...	...	...	...	...	
	F	7 55 42	...	...	...	...	...	Do.
Oct. 1st	e	18 33 18	...	...	...	...	...	
	F	18 34 30	...	...	...	...	...	Very slight local shock.
„ 3rd	e	1 49 18	...	...	...	...	...	
	M	2 56 12	...	36	64	...	...	
	F	3 49 00	...	...	...	...	...	Tremors.
„ 3rd	i	14 47 54	...	...	...	...	...	
	F	14 52 30	...	...	..	...	...	Very slight shock.
„ 14th	i	19 48 00	...	...	..	...	...	
	M	19 49 06	...	554	..	...	...	
	F	20 26 30	...	...	...	...	...	Local shock.
„ 20th	e	17 34 06	...	...	...	...	...	
	F	17 46 12	...	...	...	...	...	Very slight tremors.
„ 21st	P	19 30 42	...	...	...	...	...	
	S	19 35 30	...	..	...	...	...	
	L	19 39 48	...	...	...	...	...	On instrument recording North-South oscillations.
	L	19 41 00	...	...	..	...	...	On instrument recording East-West oscillations.
	M_1	19 40 42	25 ...	107	...	...	...	
	M_2	19 41 48	...	...	75	...	...	
	F	20 12 06	...	...	...	...	...	
„ 31st	P	15 41 12	...	...	...	...	...	
	S	15 53 54	...	...	...	...	...	
	L	16 06 06	...	...	...	...	...	
	M_1	16 06 18	18 ...	...	186	...	...	
	M_2	16 08 18		536	...	...	...	

Date.	Phase.	Time, G. M. T.	Period (Sec.)	Amplitude (μ). An.	Ae.	Az.	Distance Δ (Km.)	Remarks.
1916.		h. m. s.						
	F	17 25 48	...	...	...	...	...	
Nov. 14th	e	22 44 48	...	...	...	...	...	
	M_1	22 53 24	...	43	...	...	...	
	M_2	22 56 00	...	...	36	...	...	
	F	23 14 18	...	...	...	...	...	Slight shock.
„ 21st	e	7 36 42	...	...	...	...	...	
	F	8 34 18	...	...	...	...	...	Slight tremors.
„ 24th	e	4 19 48	...	...	...	...	...	
	F	4 42 42	...	...	..	...	...	Do.
„ 24th	e	12 31 24	...	...	...	...	...	
	F	13 22 12	...	...	...	...	...	Very slight tremors.
„ 26th	e	6 38 12	...	...	...	...	...	
	F	7 36 54	...	...	...	...	...	Do.
„ 30th	e	4 25 06	...	...	...	...	...	
	F	4 44 42	...	...	...	...	...	Slight tremors.
„ 30th	e	7 14 12	...	...	..	...	...	
	F	7 23 30	..	...	...	...	...	Very slight shock.
Dec. 1st	e	14 19 18	..	...	...	...	...	
	F	14 26 06	...	...	...	...	...	Very slight local shock.
„ 3rd	i	8 38 00	...	...	...	...	...	
	M	8 39 18	...	339	...	...	...	
	F	8 58 30	...	...	...	...	...	Local shock.
„ 6th	e	22 52 36	...	...	...	...	...	
	F	23 04 06	...	...	...	...	...	Very slight tremors
„ 10th	e	23 44 30	...	...	...	...	...	
„ 11th	F	0 00 18	...	...	...	...	...	Very slight shock.
„ 11th	e	1 06 00	...	...	...	...	...	
	F	1 24 42	...	...	...	...	...	Very slight tremors.
„ 14th	i	17 13 00	...	...	...	...	...	
	F	17 21 00	...	...	...	...	...	Very slight tremors.
„ 15th	e	21 58 42	...	...	...	...	...	
	F	22 07 48	...	...	...	...	...	Do.
„ 24th	e	7 54 06	...	...	...	...	...	
	M	7 55 06	...	121	...	...	...	
	F	8 25 42	...	...	...	...	...	Local shock.
1917. Jany. 4th	e	16 58 06	...	...	...	...	...	
	M	17 14 30	...	71	64	...	...	
	F	17 40 42	...	...	...	...	...	

Date.	Phase.	Time, G. M. T.	Period (Sec.)	Amplitude (u). An.	Ae.	Az.	Distance △ (Km.)	Remarks.
1917.		h. m. s.						
Jan. 6th	e	18 20 48	...	...	...	...	...	
	F	18 50 00	...	...	...	...	...	Very slight tremors.
„ 19th	e	2 14 54	...	...	...	...	...	
	F	2 32 18	...	...	...	...	...	Do.
„ 20th	P	23 20 42	...	...	...	...	...	
	S	23 32 54	...	...	...	...	...	
	L	23 42 42	...	...	...	...	...	On instrument recording North-South oscillations.
	L	23 44 36	...	...	...	...	...	On instrument recording East-West oscillations.
	M_1	23 43 36	18	179	...	...	...	
	M_2	23 44 48	...	...	71	...	...	
„ 21st	F	0 46 42	...	...	...	...	...	
„ 24th	P e	1 00 12	...	...	...	...	...	
	L i	1 06 54	...	...	...	...	...	
	M	1 07 12	18	104	...	...	...	
	F	1 31 12	...	...	...	...	...	
„ 30th	P	2 55 54	...	...	...	...	...	
	S	3 04 12	...	...	...	...	...	
	L	3 09 00	...	...	...	...	...	
	M_1	3 21 30	...	...	...	...	...	
	M_2	3 31 42	35 ...	>2857	...	...	...	Pendulum struck against stops.
	F	6 55 18	...	...	...	...	...	
„ 30th	e	7 59 06	...	...	...	...	...	
	F	8 00 36	...	...	...	...	...	Tremors.
„ 31st	P	4 09 00	...	...	...	...	...	
	L	4 16 24	...	...	...	...	...	
	F	4 42 18	...	...	...	...	...	
Feb. 15th	e	1 23 54	...	...	...	...	...	
	M	2 14 30	...	36	...	...	...	
	F	3 10 30	...	...	...	...	...	Do.
„ 20th	e	19 42 36	...	...	...	...	...	
	M	20 36 54	...	71	...	...	...	
	F	21 15 36	...	...	...	...	...	Do.
Mar. 15th	e	0 23 12	...	...	...	...	...	
	M	0 47 30	...	36	...	...	...	
	F	1 44 24	...	...	...	...	...	

Date.	Phase.	Time, G. M. T.	Period (Sec.)	Amplitude (u). An.	Ae.	Az.	Distance △ (Km.).	Remarks.
1917.		h. m. s.						
April 3rd	e	12 51 54	...	...	...	...	...	
	M_1	13 04 00	...	...	54	...	...	
	M_2	13 07 24	...	36	...	...	...	
	F	13 29 12	...	...	...	...	...	
„ 10th	e	1 52 48	...	...	...	...	...	
	F	1 56 06	...	...	...	...	...	Very slight tremors.
„ 12th	e	2 59 30	...	...	...	...	...	
	M_1	3 05 12	...	54	...	...	...	
	M_2	3 08 48	...	...	36	...	...	
	F	3 39 36	...	...	...	...	...	
„ 17th	e	13 38 09	...	...	...	...	...	
	F	13 52 12	...	...	...	...	...	Very slight tremors.
„ 21st	i	0 51 36	...	...	...	...	...	
	M	0 52 54	...	171	...	...	...	
	F	1 36 06	...	...	...	...	...	Local shock.
„ 24th	e	14 45 12	...	...	...	...	...	
	F	14 46 30	...	...	...	...	...	Very slight local shock.
„ 29th	e	12 07 48	...	...	...	...	...	
	M	12 18 00	...	43	...	...	...	
	F	12 49 48	...	...	...	...	...	Tremors.
May 1st	P e	18 44 54	...	...	...	...	...	
	S e	18 56 48	...	...	...	...	...	
	M_1	19 04 06	...	...	821	...	...	
	M_2	19 17 12	...	579	...	...	...	
	M_3	19 25 18	42	714	...	...	...	
	M_4	19 33 06	...	...	1071	...	...	
	F	21 45 30	...	...	...	...	...	
„ 4th	e	1 40 00	...	...	...	...	...	
	M	1 56 36	...	36	...	...	...	
	F	3 09 00	...	...	...	...	...	Tremors.
„ 6th	e	23 14 48	...	...	...	...	...	
	M	23 27 54	...	36	...	...	...	
	F	23 47 12	...	...	...	...	...	Tremors.
„ 9th	P	16 05 54	...	...	...	...	...	
	S	16 14 30	...	...	...	...	...	
	L	16 21 30	...	...	...	...	...	
	M_1	16 29 42	...	436	...	...	...	
	M_2	16 31 30	...	...	43	...	...	
	F	18 02 48	...	...	...	...	...	

Date.	Phase.	Time, G. M. T.	Period (Sec.).	Amplitude (a). An.	Ae.	Az.	Distance Δ (Km.).	Remarks.
1917		h. m. s.						
May 9th	e	21 35 36	...	..	...	...	...	
	F	?	...	...	...	...	...	Tremors. End lost in the next shock.
„ 9th	i	21 46 42	...	...	...	...	...	
	M	21 47 18	...	...	964	...	...	
	F	22 24 24	...	...	...	...	...	Local shock.
„ 29th	i	13 56 48	...	...	...	...	...	
	F	13 57 24	...	...	...	...	...	Very slight local shock.
„ 31st	P	8 59 42	...	...	...	...	...	
	S	9 09 42	...	...	..	...	...	
	L	9 28 30	...	...	...	...	...	
	M_1	9 30 06	...	...	1571	...	...	
	M_2	?	...	>2893	...	...	...	Pendulum struck against stops. Time of maximum was between 9 h. 34 m. 18 s. and 9 h. 41 m. 06 s.
	F	12 04 30	...	...	...	...	...	

The following table contains a list of earthquakes that were reported :—

TABLE 7.

Place at which felt.	Date.	G. M. T. of earthquakes.	Duration.	Intensity Rossi-Forel scale.	No. of shocks.	Remarks.
		h. m.	sec.			
Simla . . .	May 9th	21 46	60	6	1	
Lahore . .	„ 9th	21 47	30	5	2	
Srinagar . .	„ 9th	21 47	7	7	1	
Sialkot . .	„ 9th	21 50	3	7	1	
Waltair . .	„ 18th	6 40	5	6	1	
Shillong . .	„ 20th	5 25	2	4	1	

Solar radiation.—Observations not recorded owing to absence of officers on war service.

C. W. B. NORMAND,

Imperial Meteorologist, Simla.

Weather in the Indian Ocean.

7. The excess of pressure which characterized India did not extend over the Indian Ocean where all the three representative stations recorded appreciably lower pressures than usual. Winds were normal as regards direction, but were unusually strong at Seychelles and weak at Mauritius. Rainfall agreed closely with the normal at Zanzibar, but was much lighter than usual at Mauritius and Seychelles.

The general conditions over the Indian Ocean were thus distinctly favourable for monsoon rains.

TABLE 8.

	Mauritius.*	Zanzibar.	Seychelles.
Departure from normal of mean pressure	—·025	—·015	—·016
Actual mean wind direction . .	S 62° E	S 21° W	S 43° E
Normal mean wind direction . .	S 64° E	S 7° W	S 43° E
Actual mean wind velocity (miles per diem).	189	144	207
Normal mean wind velocity (miles per diem).	211	142	120
Rainfall departure from normal . .	—2·71	—0·79	—5·65

* Based on weekly telegrams.

Depressions and cyclonic storms.

Two storms were recorded as occuring in the Indian Seas, one in the Bay of Bengal and the other in the Arabian Sea. The following is a brief statement of their history.

Cyclonic storm of the 30th April to the 5th May in the Bay of Bengal.—This appeared as a shallow depression in the southwest of the Bay on the 30th April ; it travelled roughly northwards during the day and by the morning of the 2nd had reached a position nearly 300 miles to the east of Madras. It developed rapidly during the next twenty-four hours while travelling northwards and at 8 hours on the 3rd it was central about 50 or 60 miles east of False Point. The centre struck the coast between Balasore and Saugor Island in the afternoon and after following, as hitherto, a northerly course had reached the neighbourhood of Naya Dumka by the morning of the 4th. It broke up during the day in the Bengal Himalayas. The *S. S. Manica* was involved in the inner area on the morning of the 3rd. She experienced winds of hurricane violence and a very high sea, the barometer falling to 29·07″ (corrected) at 9 hours, or seven-tenths of an inch below the normal height. The storm was thus a severe one.

Cyclonic storm of the last week of May in the Arabian Sea.—This storm was encountered by the *S. S. Portsea* on 25th-26th May in the neighbourhood of the Kuria Muria Islands, but no information is available regarding its origin, character or movement.

Pressure.

9. Barometric pressure was above normal at all the recording stations in the plains with the exception of Myitkyina; the excess was least in Burma and along the west coast of the Peninsula (·02″), and greatest in the Punjab and the United Provinces, where it ranged between ·08″ and ·12″.

TABLE 9.

DIVISION.	Departure from normal of mean 8 hrs. pressure.
	″
Burma	+·015
Assam	+·028
Bengal	+·049
Bihar and Orissa	+·072
United Provinces	+·098
Punjab	+·100
North-West Frontier Province	+·064
Sind	+·054
Rajputana	+·064
Bombay	+·026
Central India	+·066
Central Provinces	+·068
Hyderabad	+·048
Mysore	+·027
Madras	+·039

The excess of pressure was chiefly a feature of the lower atmospheric strata, for at the level of the neighbouring hill stations it was either less pronounced or replaced by a defect.

TABLE 10.

HILL STATION.	Departure from normal pressure. A	PLAIN STATION.	Departure from normal pressure. B	Departure of pressure difference. B—A.
	″		″	″
Quetta	—·015	Jacobabad	+·075	+·090
Leh	—·035	Lahore	+·107	+·142
Murree	—·001	Peshawar	+·050	+·051
Simla	+·022	Ludhiana	+·115	+·093
Darjiling	+·026	Dhubri	+·033	+·007
Mount Abu	—·003	Deesa	+·036	+·039
Pachmarhi	+·012	Khandwa	+·055	+·043
Kodaikanal	—·004	Madura	+·032	+·036

Temperature.

10. Except in Burma, Assam, Bengal, south-east Madras, Mysore, the west coast districts and the North-West Frontier Province temperature was well below the normal everywhere in the Indian plains. The deficiency was more than 6° in Chota Nagpur, the United Provinces, the Punjab, Rajputana, Central India, the Central Provinces and north Hyderabad, and occurred more in the maximum than in the minimum temperature. The low temperatures persisted through nearly the whole month. The past records show that the years with lowest temperature conditions in May were 1877, 1878 and 885; but even in these years the lowness was on the whole not nearly so marked; in this respect therefore 1917 was unique. It would appear that this result was a direct consequence of the phenomenal rainfall of the month.

Temperature was low also at the hill stations from Mukteswar to Cherat, but was normal in Baluchistan and Kabul, and rather high in Kashmir.

The Baluchistan and Kashmir data thus indicate that the disturbed conditions responsible for the low temperatures recorded over the greater part of the country did not extend in any marked degree into Afghanistan or Central Asia.

TABLE 11.

SUB-DIVISION.	ACTUAL TEMPERATURE.				DEPARTURE FROM NORMAL OF		
	Mean maximum.	Mean minimum.	Monthly mean of mean between maximum and minimum.	Mean daily range of temperature.	Maximum.	Minimum.	Daily range.
	°	°	°	°	°	°	°
1. Bay Islands	88·1	78·5	83·3	9·7	—0·8	—0·6	—0·2
2. Lower Burma	90·6	75·9	83·3	14·7	+0·9	—0·5	+1·4
3. Upper Burma	96·4	75·3	85·9	21·2	+1·0	+0·3	+0·7
4. Assam	89·5	72·4	80·9	17·0	+2·4	+1·0	+1·4
5. Bengal	91·2	75·0	83·1	16·2	—1·3	—1·0	—0·3
6. Orissa	95·2	76·7	85·9	18·4	—4·8	—3·1	—1·7
7. Chota Nagpur	94·2	73·7	83·9	20·5	—8·8	—3·7	—5·1
8. Bihar	94·7	75·0	84·8	19·7	—5·1	—2·1	—3·0
9. United Provinces, East	96·1	74·7	85·4	21·3	—8·4	—3·5	—4·9
10. Do. do., West	94·9	73·1	83·9	21·8	—10·7	—6·0	—4·7
11. Punjab, East and North	92·5	71·0	81·7	21·5	—11·2	—4·3	—6·9
12. Do., South-west	95·8	72·7	84·2	23·1	—10·0	—4·4	—5·6
13. Kashmir	75·4	52·9	64·2	22·5	+2·8	+4·5	—1·7
14. North-West Frontier Province	96·7	71·6	84·1	25·1	—4·3	—0·7	—3·6
15. Baluchistan	89·6	62·3	75·9	27·3	—2·3	+0·7	—3·0
16. Sind	98·2	77·6	87·9	20·6	—4·5	—0·7	—3·8
17. Rajputana, West	95·4	72·9	84·2	22·5	—11·5	—8·7	—2·8
18. Do., East	93·1	72·4	82·7	20·7	—13·3	—9·0	—4·3
19. Gujarat	93·8	75·1	84·5	18·8	—5·7	—2·7	—3·0
20. Central India, West	92·9	68·9	80·9	24·1	—10·4	—7·9	—2·5
21. Do., East	93·7	72·7	83·3	21·0	—12·7	—7·1	—5·6
22. Berar	97·3	72·9	85·2	24·4	—8·5	—6·8	—1·7
23. Central Provinces, West	94·8	70·7	82·7	24·1	—11·5	—8·9	—2·6
24. Do., East	95·3	72·5	83·9	22·8	—10·2	—7·2	—3·0
25. Konkan	89·7	78·3	84·1	11·3	—0·6	—1·9	+1·3
26. Bombay Deccan	96·5	69·8	83·1	26·7	—4·3	—3·2	—1·1
27. Hyderabad, North	96·3	72·1	84·2	24·2	—7·2	—5·8	—1·4
28. Hyderabad, South	97·9	75·9	86·9	21·9	—6·3	—4·3	—2·0
29. Mysore	91·5	67·4	79·5	24·1	0	—1·9	+1·9
30. Malabar	89·6	76·9	83·3	12·7	+0·1	—1·1	+1·2
31. Madras, South-east	97·1	77·1	87·1	20·0	—1·2	—1·5	+0·3
32. Do. Deccan	100·2	77·9	89·0	22·2	—4·5	—2·7	—1·8
33. Do. Coast, North	94·3	77·3	85·8	17·1	—2·9	—3·8	+0·9

TABLE 12.

DIVISION.	DEPARTURE FROM NORMAL OF		
	Mean maximum temperature.	Mean minimum temperature.	Mean temperature.
	°	°	°
Burma	+1·0	—0·1	+0·4
Assam	+2·4	+1·0	+1·7
Bengal	—1·3	—1·0	—1·2
Bihar and Orissa	—6·0	—2·9	—4·4
United Provinces	—9·4	—4·6	—7·0
Punjab	—10·8	—4·3	—7·6
North-West Frontier Province	—4·3	—0·7	—2·5
Sind	—4·5	—0·7	—2·6
Rajputana	—12·6	—8·9	—10·7
Bombay	—4·2	—2·7	—3·5
Central India	—11·5	—7·5	—9·5
Central Provinces	—10·4	—8·0	—9·2
Hyderabad	—6·7	—4·9	—5·8
Mysore	0	—1·9	—1·0
Madras	—1·8	—2·1	—2·0

Winds.

11 (*a*). Winds were unusually weak and unsteady in north-east India, Rajputana, Central India and the Central Provinces. In the United Provinces, the North-West Frontier Province, Sind, Bombay and Hyderabad the velocity alone was appreciably low, while in the Punjab winds although of about normal strength were steadier than usual.

(*b*) In the north Punjab the northerly element in the mean wind direction was weaker than usual and at the level of Cherat was replaced by a southerly component; these deflections suggest the absence of any unusually heavy snowfall in the regions to the north.

TABLE 13.

DIVISION.	DEPARTURE FROM NORMAL OF	
	Hourly wind velocity.	Wind steadiness.
Burma	+0·2	+ 4
Assam	—0·5	— 7
Bengal	—1·4	—23
Bihar and Orissa	—1·3	—19
United Provinces	—1·0	0
Punjab	—0·2	+ 5
North-West Frontier Province	—1·3	— 1
Sind	—2·0	— 4
Rajputana	—1·4	—32
Bombay	—1·6	— 5
Central India	—1·4	—14
Central Provinces	—0·7	—17
Hyderabad	—1·8	— 3
Mysore	+0·1	— 4
Madras	+0·1	+ 2

Humidity and cloud.

12. Absolute humidity was rather high in Baluchistan, the North-West Frontier Province, the Punjab, the western half of the United Provinces, Central India East, the Central Provinces and the interior of Sind, and was about the average or in defect over the rest of the country. The distribution of relative humidity agreed closely with that of absolute humidity.

Skies were clouded to much more than the customary extent over practically the whole of north-western and central India, and were unusually free from cloud in upper Assam, Bengal, Mysore and the greater part of Madras.

TABLE 14.

DIVISION.	HYGROMETRY; 8 HRS.				CLOUD.	
	Mean humidity.	Departure from normal.	Mean vapour tension in inches of mercury.	Departure from normal in inches of mercury.	Mean cloud amount at 8 hrs.	Departure from normal.
	%					
Burma	77	— 4	·820	—·040	5·8	0
Assam	84	— 4	·808	+·004	5·1	—1·3
Bengal	80	— 1	·848	—·048	4·3	—0·9

Division.	Hygrometry; 8 hrs.				Cloud.	
	Mean humidity.	Departure from normal.	Mean vapour tension in inches of mercury.	Departure from normal in inches of mercury.	Mean cloud amount at 8 hrs.	Departure from normal.
	%					
Bihar and Orissa .	69	+ 4	·737	—·035	3·8	+0·9
United Provinces .	57	+10	·619	+·010	3·7	+2·2
Punjab . .	57	+18	·573	+·079	4·3	+3·2
North-West Frontier Province.	56	+11	·591	+·047	3·9	+2·3
Sind . . .	64	+ 5	·758	+·031	1·6	0
Rajputana . .	55	+16	·549	+·018	4·2	+3·1

Division.	Hygrometry; 8 hrs.				Cloud.	
	Mean humidity.	Departure from normal.	Mean vapour tension in inches of mercury.	Departure from normal in inches of mercury.	Mean cloud amount at 8 hrs.	Departure from normal.
	%					
Bombay . .	67	+ 1	·712	—·050	3·2	+0·6
Central India .	59	+18	·581	+·037	4·7	+2·5
Central Provinces .	56	+19	·568	+·070	3·9	+2·1
Hyderabad . .	59	+ 7	·630	—·017	3·1	+0·5
Mysore . .	68	— 6	·586	—·080	3·3	—1·8
Madras . .	69	— 2	·793	—·064	3·5	—0·8

Rainfall.

13. Several disturbances of the winter type entered northern India from the west. They were, however, without exception feebly marked and produced little rain in Persia, but in north-west and central India, where their activity was supplemented by an inflow of moist air from either the Bay of Bengal or the Arabian Sea, they were the cause of numerous and frequent thundershowers. In north-east India fairly widespread rain fell on most days during the first fortnight, but after this there were merely local falls. In Burma fairly general and moderate to heavy rain occurred between the 21st and the 27th, but during the rest of the month, apart from isolated falls, weather was abnormally dry. Over the greater part of the Peninsula the usual thundershowers were extremely rare, particularly on the Malabar coast where hardly any rain fell before the 28th.

The total rainfall of the month was heavier than usual in Bihar and Orissa, the United Provinces, the Punjab, the North-West Frontier Province, Baluchistan, Sind, Rajputana, Gujarat, Central India, the Central Provinces, Hyderabad and the Madras Coast North, within 10 per cent. of the normal in Kashmir, Madras South-east and the Madras Deccan, and was below the average in all other parts of the country. The largest excess occurred in Gujarat (3·7″ or 2,176 per cent.), Central India (2·5″ or 1,200 per cent.), Rajputana (2·4″ or 750 per cent.), the Central Provinces West (2·4″ or 572 per cent.), and Bihar and Orissa (1·7″ or 76 per cent.) and Sind (1·1″ or 1,027 per cent.); while the defect was more than 2″ only in the Bay Islands (3·3″ or 25 per cent.), Lower Burma (5·4″ or 41 per cent.), Assam (4·8″ or 40 per cent.) and Malabar (2·9″ or 42 per cent.).

TABLE 15.

Sub-division.	Number of rainy days.		Rainfall.			
	Actual.	Normal.	Actual.	Normal.	Departure from normal.	Percentage departure from normal.
			″	″	″	
1. Bay Islands	11·5	13·9	9·76	13·07	—3·31	— 25
2. Lower Burma	10·8	13·0	7·71	13·08	—5·37	— 41
3. Upper Burma	5·8	7·8	3·99	5·76	—1·77	— 31
4. Assam	10·6	14·3	7·15	11·92	—4·77	— 40
5. Bengal	9·0	9·0	7·01	7·79	—0·78	— 10
6. Orissa	5·6	4·5	4·57	2·84	+1·73	+ 61
7. Chota Nagpur	7·5	3·3	3·75	1·83	+1·92	+105
8. Bihar	6·2	3·2	4·32	2·26	+2·06	+ 91
9. United Provinces, East	3·3	1·2	1·63	0·62	+1·01	+163
10. Do., West	4·6	1·3	2·04	0·59	+1·45	+246
11. Punjab, East and North	3·3	1·4	1·34	0·59	+0·75	+127

Sub-division.	Number of rainy days.		Rainfall.			
	Actual.	Normal.	Actual.	Normal.	Departure from normal.	Percentage departure from normal.
			"	"	"	
12. Punjab, South-west	3·0	0·9	1·16	0·38	+0·78	+205
13. Kashmir	5·0	3·8	2·04	2·12	—0·08	— 4
14. North-West Frontier Province	2·5	1·8	1·02	0·85	+0·17	+ 20
15. Baluchistan	1·2	0·5	0·47	0·21	+0·26	+124
16. Sind	1·9	0·2	1·24	0·11	+1·13	+1027
17. Rajputana, West	4·3	0·5	2·29	0·22	+2·07	+941
18. Do., East	5·8	0·9	2·90	0·37	+2·53	+684
19. Gujarat	5·6	0·3	3·87	0·17	+3·70	+2176
20. Central India, West	6·3	0·6	2·78	0·21	+2·57	+1224
21. Do., East	6·0	0·6	2·49	0·21	+2·28	+1086
22. Berar	4·4	0·9	1·70	0·42	+1·28	+305
23. Central Provinces, West	6·4	0·9	2·42	0·36	+2·06	+572
24. Do., East	4·3	1·2	1·64	0·54	+1·10	+204
25. Konkan	2·1	1·7	0·93	1·39	—0·46	— 33
26. Bombay Deccan	1·3	2·3	0·64	1·28	—0·64	— 50
27. Hyderabad, North	3·3	1·4	1·23	0·65	+0·58	+ 89
28. Do., South	4·8	1·3	1·91	0·83	+1·08	+130
29. Mysore	3·5	5·6	2·27	3·61	—1·34	— 37
30. Malabar	3·1	7·7	4·01	6·93	—2·92	— 42
31. Madras, South-east	3·9	3·8	2·78	2·61	+0·17	+ 7
32. Do., Deccan	3·2	2·8	1·72	1·61	+0·11	+ 7
33. Do. Coast, North	6·4	3·0	3·53	2·02	+1·51	+ 75

TABLE 16.

Division.	Rainfall.			
	Actual.	Normal.	Departure from normal.	Percentage departure from normal.
	"	"	"	
Burma	5·45	8·63	—3·18	— 37
Assam	7·15	11·92	—4·77	— 40
Bengal	7·01	7·79	—0·78	— 10
Bihar and Orissa	4·04	2·30	+1·74	+ 76
United Provinces	1·85	0·60	+1·25	+208
Punjab	1·29	0·54	+0·75	+139
North-West Frontier Province	1·02	0·85	+0·17	+ 20

Division.	Rainfall.			
	Actual.	Normal.	Departure from normal.	Percentage departure from normal.
	"	"	"	
Sind	1·24	0·11	+1·13	+1027
Rajputana	2·72	0·32	+2·40	+750
Bombay	1·73	0·94	+0·79	+ 84
Central India	2·73	0·21	+2·52	+1200
Central Provinces	1·92	0·45	+1·47	+327
Hyderabad	1·55	0·73	+0·82	+112
Mysore	2·27	3·61	—1·34	— 37
Madras	2·99	2·75	+0·24	+ 9
Mean of India	3·02	2·65	+0·37	+ 14

Snowfall.

I.—AFGHANISTAN.

14. No snow fell in and around Kabul and at the end of the month the unmelted residue of the accumulations on the Paghman and Hazarajat ranges was estimated at only a few inches.

II.—NORTH-WEST FRONTIER PROVINCE.

Some snow fell on the higher hills in Dir and Swat and amounts varying between quarter of an inch and eight inches were recorded in the Kagan valley (Hazara district) on heights above 11,000 feet.

III.—KASHMIR.

(*a*) *Mountains around Srinagar.*—There was no snowfall.

(*b*) *Skardu.*—Slight snow fell on the peaks of the surrounding hills on the 26th.

(*c*) *Dras.*—No snow fell.

(*d*) *Kargil.*—Light snowfall occurred on the mountains around the station on the 20th, 21st and 25th. The accumulations at the end of the month were estimated at 2′ on the Archulla and between 2″ and 4″ on the tops of the Nakthulla, Sumerulla, Barulla and Puzgolla.

(*e*) *Leh.*—There was a fair amount of snowfall on the surrounding hills.

IV.—PUNJAB.

(*a*) *Chamba.*—On the range between the Chenab and Upper Ravi snow fell on the 10th and daily from the 15th to 18th and on that between the Upper Ravi and Beas on the 15th, 17th, 18th and 19th; the snowline came down to 10,000 feet. Towards the end of the month about 4′ snow still lay unmelted on the Chini and Sach passes (elevations about 14,000 feet).

(*b*) *Kangra.*—There were unusually frequent falls on elevations about 8,000 feet.

(*c*) *Kilba* (*Simla Hills*).—Snowfall occurred on the 7th, 12th and again daily from the 16th to the 20th down to 11,000 feet at which level the total fall amounted to 9″ in depth.

TABLE 17.

Name of pass.	Depth of accumulation at the end of the month.	
	Reported.	Normal.
Shatul	2 feet.	5 feet.
Rupin	1 „	6½ „
Brua	1½ „	6¾ „
Harang	*Nil.*	2 „

V.—UNITED PROVINCES.

(*a*) *Garhwal.*—The snowfall of the month is said to have been heavier than usual.

(*b*) *Almora.*—During the first twenty-five days snow fell to a total depth of 7½′ in Byans and Malla Darma, 5⅓′ in Chaudas, 4′ in Malla Danpur and 1′ in Malla Johar. The lowest descent below the perpetual snows was to a distance of 4½ miles in Byans.

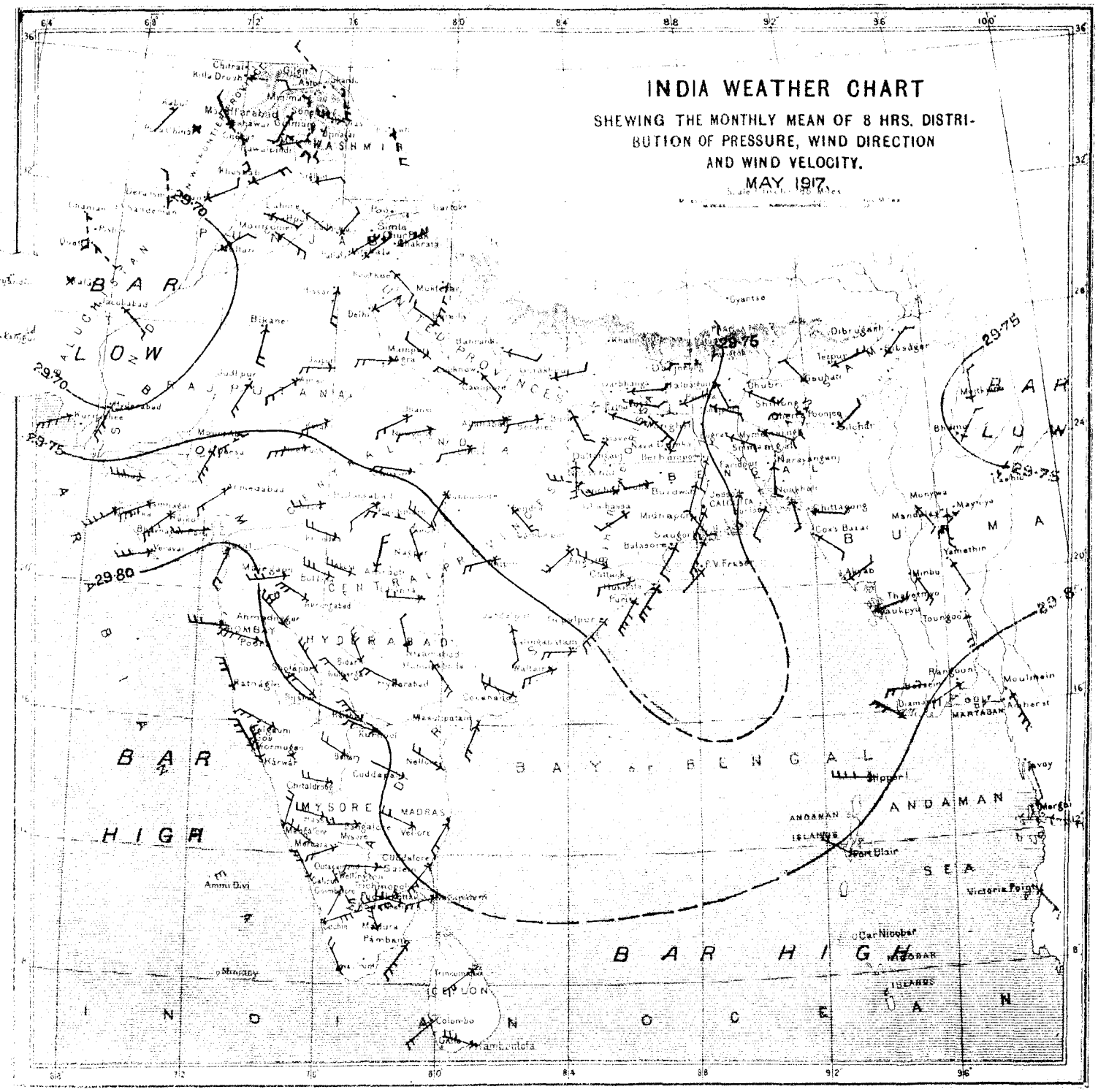
TABLE 18.

Name of pass or peak.	Depth of accumulation at the end of the month.	
	Reported.	Normal.
	Feet.	Feet.
Nuwe Pass	13½	20⅓
Lampia „	14	10½
Lipulekh „	13	8⅓
Binkaru „	11	14
Khaphini Peak	4	2½
Kuntela „	4	...
Bagdwar	4	...

SUMMARY.

15. Snowfall was more frequent and heavier than usual over the area from Chamba to Almora, while in the regions to the west of Chamba there were merely a few light local falls. At the end of the month the unmelted residue of the accumulations was in decided excess over the greater part of the Himalayas east of Chamba and in conspicuous defect in Kashmir and Afghan hills.

HEMRAJ.

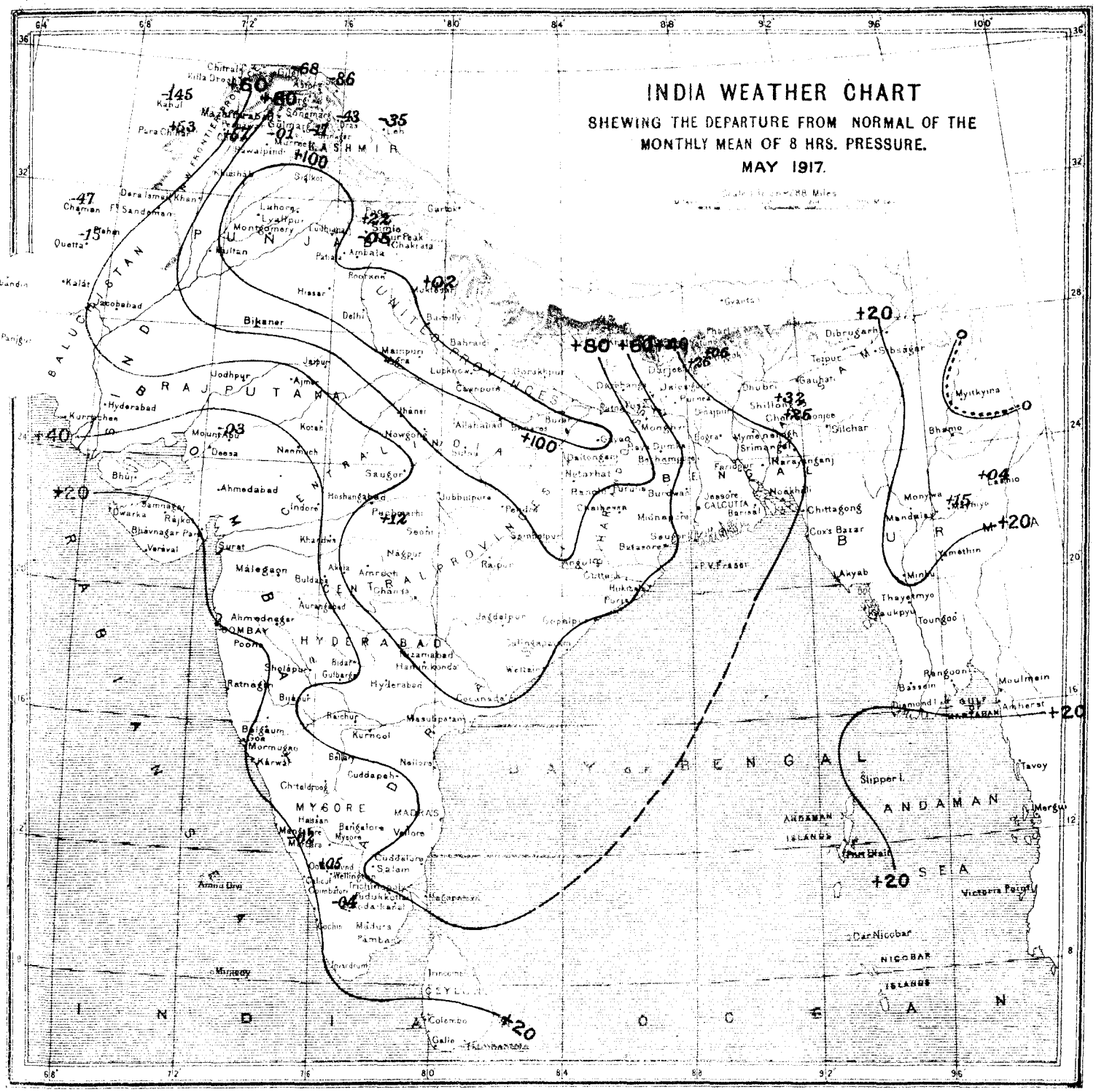


The lines of the above chart represent isobars or lines of equal barometric pressure, the numbers attached indicating the barometric pressure in inches and being drawn for differences of pressure of ·05 inch. The isobars in the Bay of Bengal are filled in by means of the shore observations, and by comparison with the normal distribution of pressure.

The mean 8 hrs. wind directions of the month are shewn by means of arrows flying with the wind, and are calculated by means of Lambert's formula applied to the winds as given in Table B of the 8 hrs. observations. The mean wind directions for the hill stations are indicated by broken arrows to distinguish them from the wind arrows for the plain stations. The mean velocity of the winds during the month is shewn by the following notation:—

Velocity of	0 to 2	miles per hour	...	one	feather added to the wind arrow.						
,,	,, 2 to 5	,,	,,	,,	...	two	feathers	,,	,,	,,	,,
,,	,, 5 to 10	,,	,,	,,	...	three	,,	,,	,,	,,	,,
,,	,, 10 to 20	,,	,,	,,	...	four	,,	,,	,,	,,	,,
	over 20	,,	,,	,,	...	five	,,	,,	,,	,,	,,

Wind strengths are based on factor 2·2 for the standard type of Beckley Robinson anemograph, instead of 3·0 as used for this plate up to December 1911 inclusive.



The chart shows the departure from normal of the mean during the month of 8 hrs. pressure by means of lines drawn for equal amounts of departure. The numbers are given in thousandths of an inch, 20 representing ·020″ or two hundredths of an inch, &c. Continuous lines indicate that the pressure was in excess by amounts indicated by the numbers attached to the lines, and broken or dotted lines that it was in defect by amounts indicated by the numbers attached to the lines. Two parallel lines near to each other, one continuous and the other broken or dotted, represent the line of no departure, the dotted line facing the area of deficient pressure or negative departures.

CHART SHEWING THE DEPARTURE FROM NORMAL
OF THE MONTHLY MEAN OF DAILY
MAXIMUM TEMPERATURE.

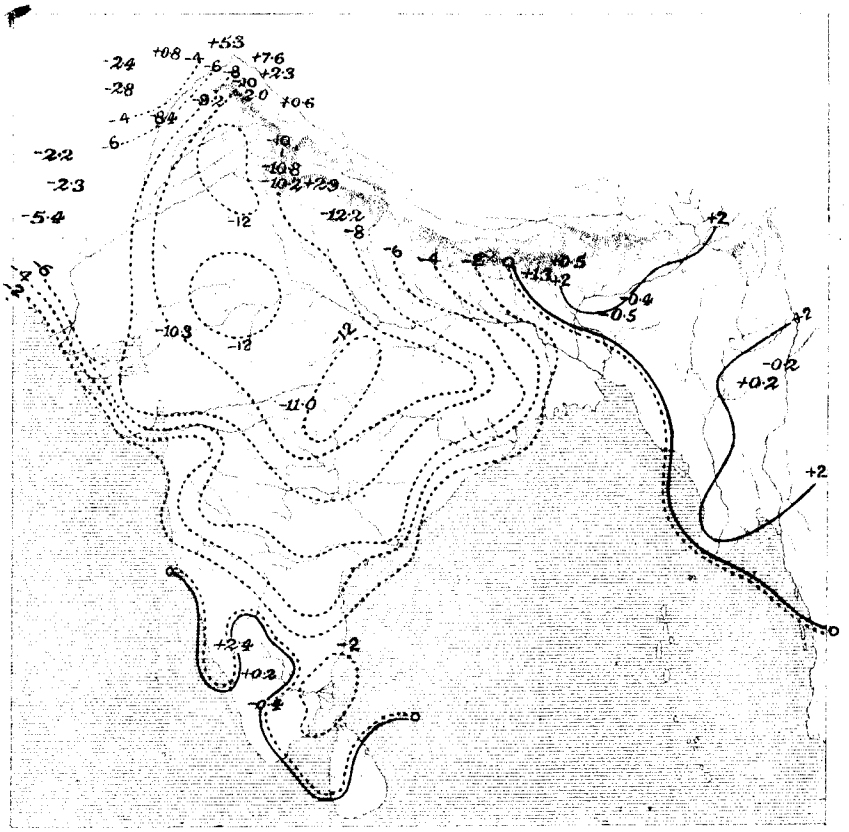


CHART SHEWING THE DEPARTURE FROM NORMAL
OF THE MONTHLY MEAN OF DAILY
MINIMUM TEMPERATURE.

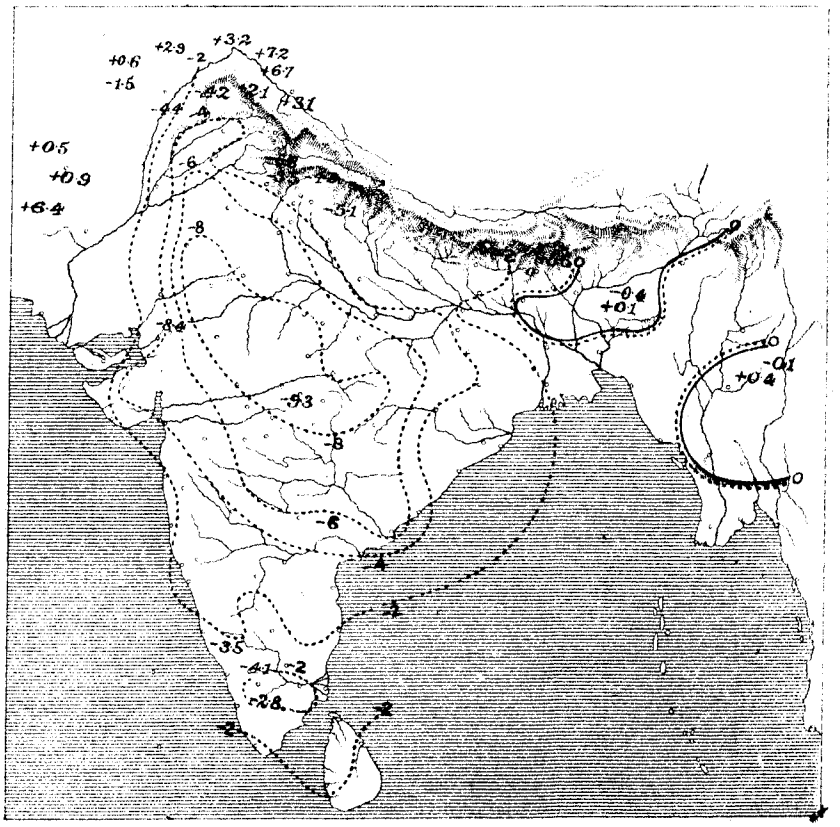


CHART SHEWING THE DEPARTURE FROM NORMAL
OF THE MONTHLY MEAN OF DAILY
MEAN TEMPERATURE.

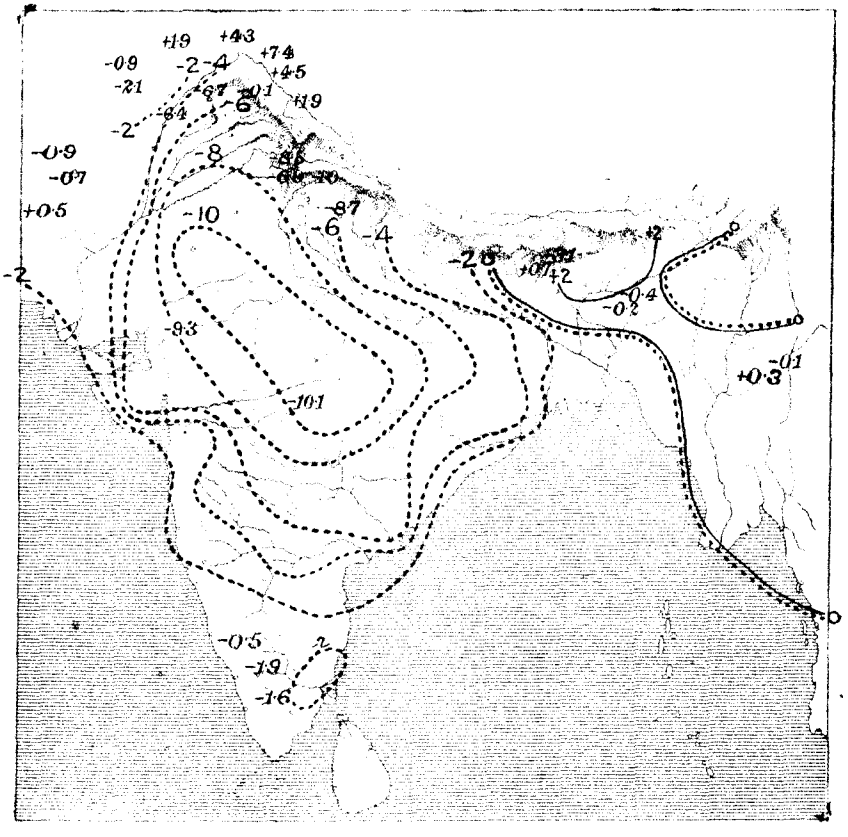


CHART SHEWING THE DEPARTURE FROM NORMAL
OF THE MONTHLY MEAN OF ABSOLUTE
HUMIDITY AT 8 HRS.

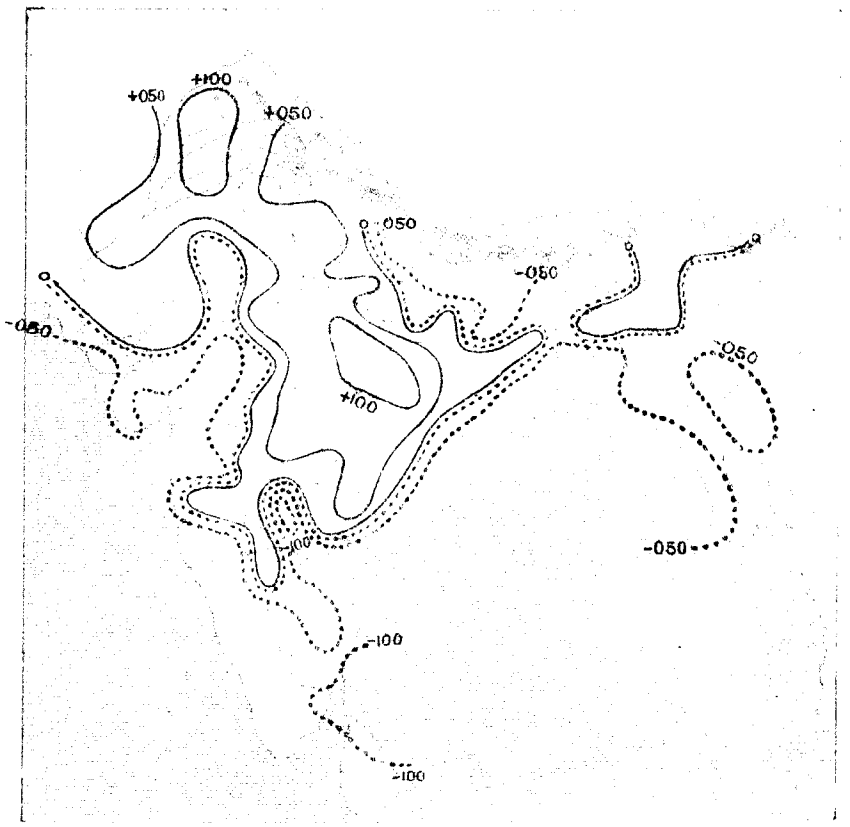
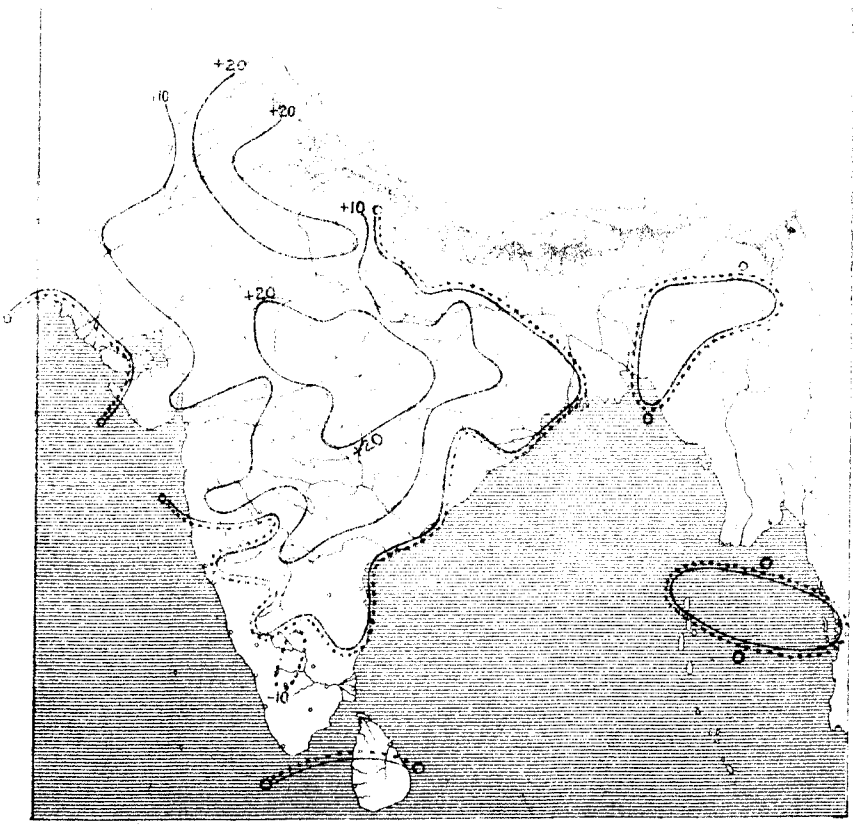
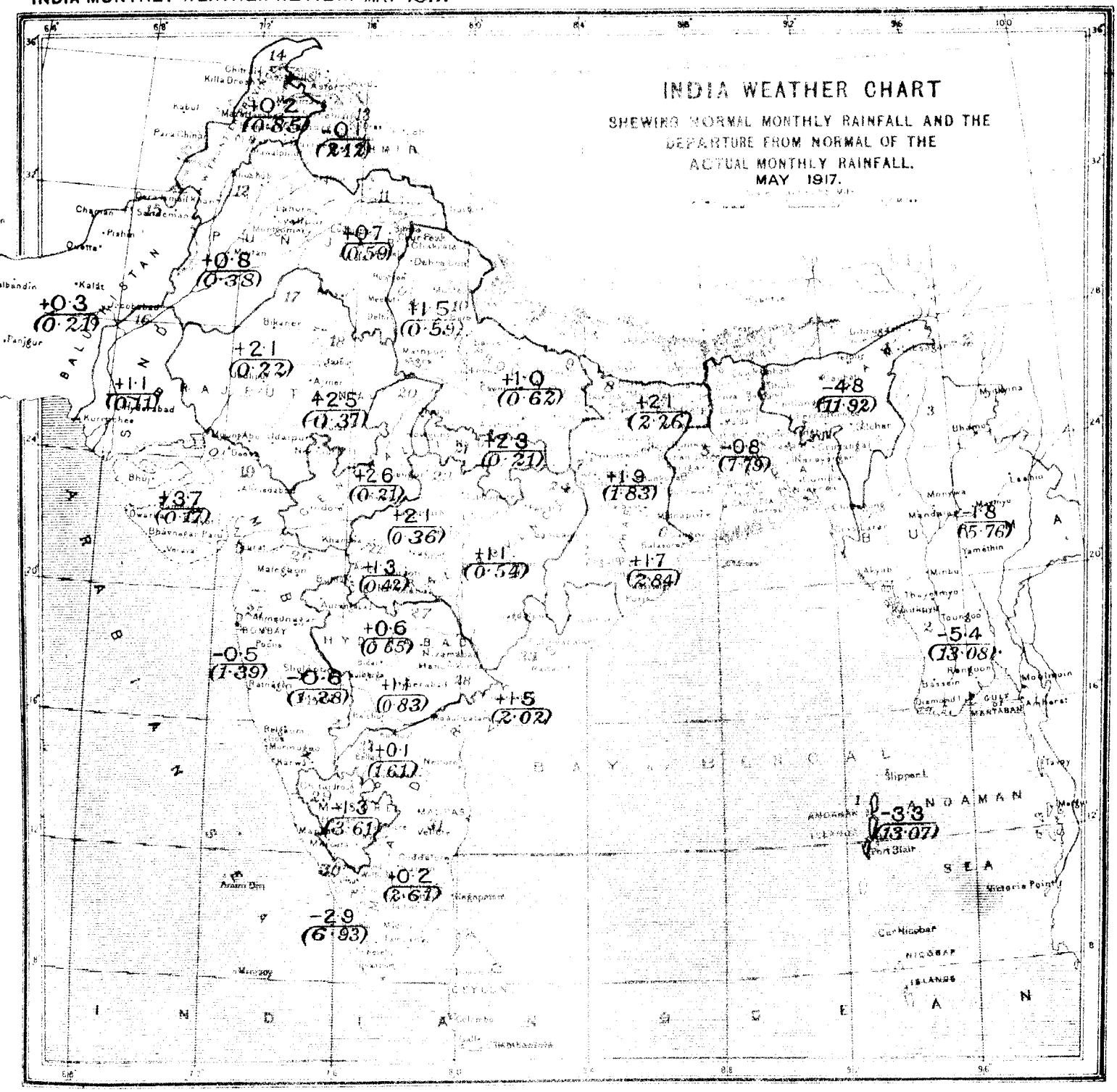


CHART SHEWING THE DEPARTURE FROM NORMAL
OF THE MONTHLY MEAN OF RELATIVE
HUMIDITY AT 8 HRS.





The country is divided into 33 areas as shewn in the list below. The numbers in that list correspond with the red numbers on the chart, and serve to identify the areas. The numbers in brackets on the chart give the average over the divisions of the normal monthly rainfall, the numbers above these give the departures from normal of the average actual rainfall over the divisions.

1. Bay Islands
2. Lower Burma
3. Upper Burma
4. Assam
5. Bengal
6. Orissa
7. Chota Nagpur
8. Bihar
9. United Provinces, East
10. United Provinces, West
11. Punjab, East and North
12. Do., Southwest
13. Kashmir
14. Northwest Frontier Province
15. Baluchistan
16. Sind
17. Rajputana, West
18. Rajputana, East
19. Gujarat
20. Central India, West
21. Do., East
22. Berar
23. Central Provinces, West
24. Do., East
25. Konkan
26. Bombay, Deccan
27. Hyderabad, North
28. Hyderabad, South
29. Mysore
30. Malabar
31. Madras, Southeast
32. Madras, Deccan
33. Madras Coast, North

GOVERNMENT OF INDIA.

METEOROLOGICAL DEPARTMENT.

MONTHLY WEATHER REVIEW

PUBLISHED BY ORDER OF

THE GOVERNMENT OF INDIA.

CALCUTTA, JUNE, 1917.

INTRODUCTION.

THIS review of the weather in India during the month of June, 1917, is based on observations taken daily at 8 hrs. at 217 stations, and on additional observations taken at 10 hrs. and 16 hrs. at 11 stations. In the rainfall summary have been utilized the data furnished by the meteorological observatories, and the rainfall statements of the month published by the Provincial Governments.

The brief notes on solar, magnetic and seismic disturbances are supplied by the chief observatories in the Indian area.

For a statement of the methods adopted in recording and tabulating the data, for each of the elements of observation, reference should be made to the introductory portion of the review for January.

Summary of the chief features of the weather in India during the month.

2. The most noteworthy feature of the month was the early beginning of the monsoon rains. The Arabian Sea monsoon arrived on the west coast at about the normal date and extended into the central parts of the country with the usual rapidity. The Bay current on the other hand appeared in north-east India nearly two weeks before the usual time, while in the Punjab and the north-west of the United Provinces the first burst of the rainy season occurred on June 2nd, about three weeks ahead of the average date, and over the rest of the United Provinces on the 19th. In the interior the currents were not so steady as usual, but except for a short interval from the 21st to 25th there was no extensive break.

The month was on the whole one of abundant and well-distributed rainfall. Thus the total fall over the plains of India exceeded the normal by 1·8″ or 25 per cent., and the only division which did not participate in the general excess was Sind where a defect of 40 per cent. was recorded. The excess amounted to 3″ in Assam, 2½″ in the Central Provinces and in Bihar and Orissa, 2″ in Rajputana, Central India and Madras, and varied between 1″ and 2″ in Burma, Bengal, the Punjab, Bombay, Hyderabad and Mysore.

Over a large part of the country, owing to the excess of rainfall, humidity and cloud were above normal and temperature was inclined to be low.

Barometric pressure in the plains averaged ·017″ in defect.

Solar, magnetic and seismic disturbances.

KODAIKANAL OBSERVATORY.

3. *Solar Observations.*—The sun could not be examined for spots and faculæ on 4 days during the month and prominences could not be recorded on 8 days.

Sunspots.—Twenty-one new groups of spots were observed as against 30 in May. The daily average number was 6·9 and the average life of a spot was 8·5 days, the averages for the preceding month being 6·7 and 7·2 respectively. The distribution of the spots in latitude was as follows:—

TABLE 1.

—	0°—10°	11°—20°	21°—30°	Mean latitude.	Extreme latitudes.
North . . .	4	8	...	12°·8	5° and 19°
South . . .	3	3	3	15°·2	4° and 25°

Prominences.—Fifty-six large, one metallic and two eruptive prominences were recorded during the month. The greatest height attained was 200″ and was recorded on the 10th and 11th in about the same region of the north-east limb.

Magnetic disturbances.—"Great" disturbances were recorded on the 7th and from 23rd to 25th and "Moderate" disturbances from 8th to 10th, 13th to 14th and on the 22nd and 26th.

J. EVERSHED,
Director,
Kodaikanal and Madras Observatories.

Seismic records.

$\phi = 10° 13' 50''$ N; $\lambda = 77° 28' 00''$ E; $h = 2{,}343$ m. Subsoil Rock.

Apparatus.—Milne's Horizontal Pendulum Seismograph.

TABLE 2.

	V	To	ϵ	$\frac{r}{To^2}$
AN:				
AE:	9·76	17·4	1	2·7
AZ				

Date.	Phase.	Time G. M. T.	Period (Sec.).	Amplitude (u). An.	Ae.	Az.	Distance Δ (Km.).	Remarks.
1917.		h. m. s.						
June 3rd	e P	14 58 00	...	...	...	...	...	Widening of line.
	F	15 19 12	...	...	...	...	...	
„ 9th	e P	9 46 00	...	...	...	...	...	
	i L	9 48 48	...	...	...	...	...	
	M	9 49 36	...	...	40	...	...	
	F	10 27 30	...	...	...	...	...	
„ 9th	e P	17 53 36	...	...	...	...	...	
	e L	18 01 54	...	...	...	...	...	
	M	18 05 24	...	...	70	...	...	
	F	18 23 48	...	...	...	...	...	
„ 13th	e P	7 01 30	...	...	...	...	...	
	i L	7 07 42	...	...	...	...	...	
	M	7 49 42	...	...	600	...	...	
	F	...	...	...	...	...	...	Overlapping.
„ 13th	P_s	...	...	...	...	...	...	
	e L	9 56 42	...	...	...	...	...	
	M	10 00 12	...	...	50	...	...	
	F	10 21 48	...	...	...	...	...	
1917.		h. m. s.						
June 24th	e P	20 08 00	...	...	...	...	...	
	i L	20 17 24	...	...	...	...	...	
	M	20 18 12	...	...	70	...	...	
	F	...	...	...	...	...	...	Overlapping.
„ 24th	P	...	...	...	...	...	...	
	i L	20 51 18	...	...	...	...	...	
	M	20 58 12	...	...	50	...	...	
	F	21 13 06	...	...	...	...	...	
„ 26th	i P	6 04 24	...	...	...	...	...	
	i L	6 08 42	...	...	...	...	...	
	M_1	6 19 36	...	...	500	...	...	
	M_2	6 55 06	...	...	700	...	...	
	M_3	6 56 42	...	...	650	...	...	
	M_4	7 02 48	...	...	1080	...	...	
	F	10 48 30	...	...	...	...	...	

T. ROYDS,
Assistant Director.

BOMBAY OBSERVATORY.

Alibag magnetic record.

4. During the month of June, 1917, the traces showed 16 calm days, 13 days of small and 1 day of moderate disturbance.

The days of the month selected as "quiet" for the purposes of the Magnetic Survey of India are the 2nd, 12th, 15th, 20th and 27th.

The following table represents the magnetic character of each day during the month:—

TABLE 3.

Day.	Character.	Day.	Character.	Day.	Character.	Day.	Character.
1	C	9	S	17	S	25	S
2	C	10	S	18	C	26	S
3	C	11	C	19	C	27	C
4	S	12	C	20	C	28	C
5	C	13	S	21	C	29	C
6	S	14	S	22	S	30	C
7	S	15	C	23	S	...	...
8	S	16	C	24	M	...	...

C=calm; S=small; M=moderate; G=great; V. G.=very great.

The mean observed absolute values of the several magnetic elements reduced to the mean monthly tabulations of the magnetograms as also the ranges and the summed ranges of the horizontal force and declination for the month are as follows :—

Easterly declination	0° 32′ 34″.
Horizontal force	0·36887 C.G.S. unit.
Vertical force	0·16878 C.G.S. „
Inclination	24° 35′·2.
Horizontal force range	0·00061 C.G.S. unit.
„ „ summed range	0·00450 C.G.S. „
Declination range	4′·9.
„ summed range	22′·4.

(NOTE.—Summed range means sum without regard to sign of the twenty-four ordinates of the diurnal inequality.)

Seismic records.

$\phi = 18° 53′ 36″$ N ; $\lambda = 72° 48′ 56″$ E ; $h = 11$ m. Subsoil Trap.

Apparatus.—Milne's Horizontal Pendulum Seismograph.

TABLE 4.

	V	To	ϵ	$\frac{r}{To^2}$
AN :				
AE :	9	21 (1st to 22nd) 19 (23rd to 30th).	1	
AZ :				

Date.	Phase.	Time G. M. T.	Period (Sec.).	Amplitude (u). An.	Ae.	Az.	Distance Δ (Km.).	Remarks.
1917.		h. m. s.						
June 2nd	...	m m 0 13 to 17	...	...	...	...	...	Thickening of line.
„ 4th	P	2 7 46	...	...	...	...	...	
	M	2 31 10	...	...	33	...	...	
	F	2 50 46	...	...	...	...	...	
„ 8th	P	...	...	...	...	...	...	Beginning mixed in tremors.
	M	2 24 40	...	...	44	...	...	
	F	2 56 40	...	...	...	...		
„ 9th	P	18 1 39	...	...	...	...	...	
	M	18 8 39	...	...	33	...	...	
	F	18 19 44	...	...	...	...	...	
June 13th	P	7 0 37	...	...	...	...	...	
	M	7 53 41	...	...	178	...	...	
	F	9 9 29	...	...	...	...	...	
„ 16th	...	18 37 00	...	...	...	...	...	Thickening of line.
„ 26th	P	6 9 32	...	...	...	...	...	
	M	7 5 32	...	...	922	...	...	
„	F	...	...	...	...	...	...	End mixed in tremors.
„ 27th	...	m m 8 39 to 44	...	...	...	...	...	Thickening of line.

Sensibility to tilt 1·0 mm. of amplitude on the trace = 0·32″.

N. A. F. MOOS,
Director,
Bombay and Alibag Observatories.

5.—CALCUTTA (ALIPORE) OBSERVATORY.

Seismic records.

$\phi = 22° 32′$ N ; $\lambda = 88° 20′$ E ; $h = 6·4$ m. Subsoil Alluvial.

Apparatus.—Two Omori-Ewing Horizontal Pendulum Seismographs.

TABLE 5.

	V	To	ϵ	$\frac{r}{To^2}$
AN :	29	18	1	
AE :	29	42	1	
AZ :				

Date.	Phase.	Time G. M. T.	Period (Sec.).	Amplitude (u). An.	Ae.	Az.	Distance Δ (Km.).	Remarks.
1917.		h. m. s.						
June 17th	P	18 31 6	3	...	...	...	...	
	S	18 32 48	8	...	...	...	...	
	F	18 48 48	...	...	...	...	...	
„ 26th	P	6 3 54	6	...	...	...	...	
	S	6 15 48	18	...	...	...	...	
	L	6 23 12	19	...	...	...	...	
	M	6 57 6	..	1414	...	...	...	
	F	8 23 24	...	...	...	...	...	

6.—SIMLA OBSERVATORY.

Seismic records.

$\phi = 31° 6' N$; $\lambda = 77° 11' E$; $h = 2433{\cdot}5$ m. Subsoil Rock.

Apparatus.—Two Omori-Ewing Horizontal Pendulum Seismographs (Masses 50 Kg.).

TABLE 6.

	V	To	ϵ	$\frac{r}{To^2}$
AN:	14	45	1	
AE:	14	45	1	
AZ:				

Date.	Phase.	Time G. M. T.	Period (Sec.).	Amplitude (u). An.	Ae.	Az.	Distance Δ (Km.).	Remarks.
1917.		h. m. s.						
June 4th	e	1 51 18	...	...	...	...	...	
	M	2 17 54	...	79	...	...	...	
	F	2 37 30	...	...	...	...	...	Tremors.
„ 7th	e	3 33 0	...	...	...	...	...	
	F	3 50 24	...	...	...	...	...	slight tremors.
„ 8th	e	1 34 36	...	...	...	...	...	
	M	2 1 36	...	79	...	...	...	
	F	3 5 36	...	...	...	...	...	Tremors.
„ 10th	e	5 23 24	...	...	...	...	...	
	M	5 34 0	...	32	...	...	...	
	F	6 3 54	...	...	...	...	...	Tremors.
„ 13th	e	7 3 24	...	...	...	...	...	
	M_1	7 54 30	...	...	29	...	...	
	M_2	7 58 48	...	71	...	...	...	
	F	9 13 36	...	...	...	...	...	Tremors.
„ 13th	e	10 0 42	...	...	...	...	...	
	F	10 12 24	...	...	...	...	...	Very slight tremors.
„ 16th	e	18 30 6	...	...	...	...	...	
	M	18 31 24	...	36	...	...	...	
	F	18 42 36	...	...	...	...	...	
June 24th	e	20 7 54	...	...	...	...	...	
	F	21 16 48	...	...	...	...	...	Slight tremors.
„ 26th	P	6 9 0	...	...	...	...	...	
	S	6 17 6	...	...	...	...	...	
	L	6 25 12	...	...	...	...	...	
	M_1	6 51 6	...	2036	...	...	...	
	M_2	6 52 12	36	...	1071	...	...	
	F	9 56 54	...	...	...	...	...	

The following table contains a list of earthquakes that were reported :—

TABLE 7.

Place at which felt.	Date.	G. M. T. of earthquake.	Duration.	Intensity Rossi-Forel scale.	No. of shocks.	Remarks.
		h. m.	sec.			
Drosh . . .	June 21st	8 45	50	7	2	
Gulmarg (Kashmir)	„ 21st	8 48	40	6	2	
Srinagar . .	„ 21st	8 48	40	7	2	
Cherat . .	„ 21st	8 49	60	6	1	
Kabul (Afghanistan)	„ 25th	9 4	12	4	3	
Deesa . . .	„ 29th	16 25	2	4	1	

Solar radiation.—Observations not recorded owing to the absence of officers on war service.

C. W. B. NORMAND,
Imperial Meteorologist, Simla.

Weather in the Indian Ocean.

7. Barometric pressure was lower than usual at all the three representative stations, the defect being as much as ·09″ at Mauritius. The air movement was fairly normal in direction, but was stronger than usual at Seychelles and weaker at Zanzibar. Rainfall was irregularly distributed, being upwards of 75 per cent. below the average at Seychelles, nearly normal at Mauritius and in large excess at Zanzibar.

The general conditions over the Indian Ocean were thus favourable for the prevalence of a strong monsoon over the land area of India.

TABLE 8.

	Mauritius.*	Zanzibar.	Seychelles.
Departure from normal of mean pressure	—·087	—·057	—·038
Actual mean wind direction . .	S 62° E	S 21° W	S 27° E
Normal mean wind direction . .	S 61° E	S 13° W	S 27° E
Actual mean wind velocity (miles per diem).	233	125	243
Normal mean wind velocity (miles per diem).	249	154	188
Rainfall departure from normal . .	+0·11	+2·41	—3·68

*Based on weekly telegrams.

Depressions and cyclonic storms.

8. The advance of the monsoon in the east of the Arabian Sea was as usual associated with a wave of low pressure, but the low pressure conditions failed to concentrate into a definite depression. On the 13th however a disturbance formed between the meridian of 66° E and the Kathiawar coast; thence it travelled north-westwards towards the entrance to the Persian Gulf where it disappeared sometime on the 15th. It was probably of only moderate intensity.

Over the Bay three depressions were recorded during the month. The first of these appeared on the 4th off the Coromandel coast and after travelling slowly northwards disappeared off the Orissa coast on the 10th. It was throughout feeble, but had the effect of preventing the Bay monsoon from extending well inland. The second was observed over the head of the Bay on the 17th. It travelled roughly along a north-westerly track and disappeared over Bihar during the 22nd. It was diffuse throughout its existence and did not produce any marked concentration of rainfall. The third depression was generated on the 26th over the north-west angle of the Bay; it advanced north-westwards and died out in the neighbourhood of Jhansi on the 30th. Like its predecessor it was also of slight intensity and did not cause any remarkable falls of rain.

Over the land area of India, only one depression occurred during the month. This originated over lower Bengal on the 13th and advanced in a westnorthwesterly direction during the next three days and disappeared over Rajputana on the 16th. Although shallow it was noteworthy for introducing the rains into the United Provinces and the Punjab.

Pressure.

9. Atmospheric pressure in the plains of India was on the mean of the month ·017″ lower than usual. The defect was insignificant in Burma, north-east India, the United Provinces and the north-east of the Peninsula, and was most pronounced in Gujarat where it averaged ·05″.

TABLE 9.

Division.	Departure from normal of mean 8 hrs. pressure.
	″
Burma	—·001
Assam	—·006
Bengal	—·007
Bihar and Orissa	—·001
United Provinces	—·007
Punjab	—·018
North-West Frontier Province	—·034
Sind	—·034
Rajputana	—·031
Bombay	—·039
Central India	—·023
Central Provinces	—·017
Hyderabad	—·016
Mysore	—·020
Madras	—·018

The vertical gradient was on the whole of about the average strength.

TABLE 10.

Hill station.	Departure from normal pressure. A.	Plain station.	Departure from normal pressure. B.	Departure of pressure difference B—A.
	″		″	″
Quetta . . .	—·027	Jacobabad . .	—·039	—·012
Leh . . .	—·032	Lahore . .	—·015	+·017
Murree . . .	—·049	Peshawar . .	—·040	+·009
Simla . . .	—·019	Ludhiana . .	—·009	+·010
Darjiling . .	—·009	Dhubri . .	—·002	+·007
Mount Abu . .	—·022	Deesa . . .	—·035	—·013
Pachmarhi . .	—·041	Khandwa . .	—·024	+·017
Kodaikanal . .	—·027	Madura . .	—·019	+·008

Temperature.

10. The departures from normal of temperature conditions were determined mainly by those of rainfall. Maximum temperature was sensibly normal in Burma, Assam, Bengal, Kashmir, the North-West Frontier Province, Baluchistan, Sind, Cutch, the Konkan and Malabar, and was appreciably below the average elsewhere; the deficiency equalled or exceeded 4° in Chota Nagpur, the east and north Punjab, Rajputana, Central India, the Central Provinces proper, Hyderabad, the Madras Deccan and on the north Madras coast. The departures from normal of minimum temperature had a distribution similar to that of maximum temperature, but were smaller in amount.

TABLE 11.

SUB-DIVISION.	ACTUAL TEMPERATURE.				DEPARTURE FROM NORMAL OF		
	Mean maximum.	Mean minimum.	Monthly mean of mean between maximum and minimum.	Mean daily range of temperature.	Maximum.	Minimum.	Daily range.
	°	°	°	°	°	°	°
1. Bay Islands	85·2	77·9	81·5	7·3	—0·7	+0·1	—0·8
2. Lower Burma	85·3	75·1	80·2	10·2	—0·5	—0·9	+0·4
3. Upper Burma	90·1	75·5	82·8	14·6	—0·5	—0·2	—0·3
4. Assam	88·2	75·3	81·8	12·9	0	+0·1	—0·1
5. Bengal	88·7	77·6	83·1	11·2	—1·1	—0·4	—0·7
6. Orissa	90·8	78·2	84·5	12·6	—3·5	—1·7	—1·8
7. Chota Nagpur	91·6	76·4	84·0	15·2	—4·1	—1·6	—2·5
8. Bihar	92·5	78·7	85·6	13·9	—2·8	—0·5	—2·3
9. United Provinces, East	97·0	79·9	88·5	17·1	—3·2	—1·3	—1·9
10. Do. do., West	99·2	81·1	90·1	18·2	—3·5	—1·6	—1·9
11. Punjab, East and North	100·3	79·1	89·7	21·2	—3·9	—1·5	—2·4
12. Do., South-west	105·5	82·8	94·2	22·7	—2·0	0	—2·0
13. Kashmir	81·7	56·7	69·2	25·0	+1·4	+2·8	—1·4
14. North-West Frontier Province	108·1	80·5	94·3	27·6	+1·3	+1·3	0
15. Baluchistan	101·5	69·8	85·6	31·7	+2·8	+0·7	+2·1
16. Sind	103·7	84·6	94·2	19·2	+0·7	+1·8	—1·1
17. Rajputana, West	102·5	82·7	92·7	19·9	—3·3	—1·5	—1·8
18. Do., East	98·2	80·6	89·4	17·5	—4·9	—1·7	—3·2
19. Gujarat	93·8	79·4	86·6	14·3	—2·2	—0·5	—1·7
20. Central India, West	92·4	74·8	83·5	17·6	—4·6	—1·9	—2·7
21. Do. do., East	96·3	79·5	87·9	16·9	—5·0	—3·1	—1·9
22. Berar	94·0	75·2	84·6	18·8	—2·4	—1·0	—1·4
23. Central Provinces, West	94·1	75·7	85·0	18·4	—4.6	—3·3	—1·3
24. Do. do., East	90·7	74·2	82·4	16·5	—5·3	—3·3	—2·0
25. Konkan	85·1	76·6	80·9	8·5	—1·6	—1·1	—0·5
26. Bombay Deccan	87·1	70·9	79·0	16·3	—3·5	—0·6	—2·9
27. Hyderabad, North	91·4	73·0	82·2	18·4	—4·5	—2·0	—2·5
28. Do., South	91·1	74·3	82·7	16·7	—4·7	—1·9	—2·8
29. Mysore	82·0	67·4	74·7	14·6	—2·1	—0·4	—1·7
30. Malabar	83·1	74·5	78·7	8·7	—1·5	—0·5	—1·0
31. Madras, South-east	93·4	77·0	85·2	16·3	—3·0	—0·9	—2·1
32. Do. Deccan	93·5	76·4	84·9	17·2	—3·8	—1·4	—2·4
33. Do. Coast, North	91·0	78·8	84·9	12·2	—4·6	—2·2	—2·4

TABLE 12.

Division.	Departure from normal of		
	Mean maximum temperature.	Mean minimum temperature.	Mean temperature.
	°	°	°
Burma	—0·5	—0·6	—0·5
Assam	0	+0·1	+0·1
Bengal	—1·1	—0·4	—0·7
Bihar and Orissa	—3·3	—1·2	—2·3
United Provinces	—3·3	—1·4	—2·4
Punjab	—3·3	—1·1	—2·2
North-West Frontier Province	+1·3	+1·3	+1·3
Sind	+0·7	+1·8	+1·3
Rajputana	—4·1	—1·5	—2·9
Bombay	—2·4	—0·7	—1·5
Central India	—4·8	—2·5	—3·7
Central Provinces	—4·1	—2·6	—3·3
Hyderabad	—4·6	—1·9	—3·3
Mysore	—2·1	—0·4	—1·2
Madras	—3·2	—1·2	—2·2

Winds.

11. (*a*) The air movement was lighter than usual in the greater part of northern and central India as well as in Bombay and Hyderabad.

(*b*) The steadiness was very low in Bengal, and appreciably high in Assam, the United Provinces, the Punjab, the North-West Frontier Province, Rajputana, Central India and Hyderabad.

(*c*) There were no marked irregularities in the direction of air movement.

TABLE 13.

Division.	Departure from normal of	
	Hourly wind velocity.	Wind steadiness.
Burma	0	+ 3
Assam	+0·1	+ 6
Bengal	—1·0	—15
Bihar and Orissa	—0·6	— 3
United Provinces	—0·4	+ 8
Punjab	+0·2	+ 9
North-West Frontier Province	—0·9	+11
Sind	—1·5	— 4
Rajputana	—0·3	+ 5
Bombay	—1·6	— 1
Central India	—0·9	+ 5
Central Provinces	—0·4	— 2
Hyderabad	—1·5	+ 6
Mysore	+0·6	+ 1
Madras	—0·1	+ 3

Humidity and cloud.

12. Humidity, both absolute and relative, was appreciably higher than usual in the Punjab, the west of the United Provinces, Central India, the Central Provinces, east Hyderabad and the Madras Deccan, while in Rajputana and Bihar and Orissa the relative humidity alone was in excess.

The cloud proportion was low in Sind and the North-West Frontier Province, and either about the average or above it in the remaining divisions. The excess was most pronounced in Bihar and Orissa, Bombay, Central India, the Central Provinces, and Hyderabad.

TABLE 14.

Division.	Hygrometry; 8 hrs.				Cloud.	
	Mean humidity.	Departure from normal.	Mean vapour tension in inches of mercury.	Departure from normal in inches of mercury.	Mean cloud amount at 8 hrs.	Departure from normal.
	%					
Burma	88	0	·871	—·018	8·4	+0·7
Assam	90	0	·900	—·009	7·9	+0·3
Bengal	88	+ 1	·943	—·011	7·5	+0·3
Bihar and Orissa	82	+ 5	·904	+·011	7·1	+1·5
United Provinces	69	+ 6	·853	+·065	4·0	+0·2
Punjab	60	+10	·759	+·091	2·4	+0·3
North-West Frontier Province.	51	+ 3	·705	+·087	1·1	—0·4
Sind	66	0	·911	+·039	1·9	—0·5
Rajputana	63	+ 9	·795	+·024	3·2	+0·5
Bombay	80	+ 4	·848	0	7·5	+1·3
Central India	75	+11	·811	+·066	6·3	+1·0
Central Provinces	75	+11	·769	+·056	6·4	+0·9
Hyderabad	80	+11	·759	+·041	7·4	+1·6
Mysore	83	+ 2	·641	—·013	7·9	—0·1
Madras	78	+ 5	·822	+·004	6·9	+0·7

Rainfall.

13. At the beginning of the month the first advance of the monsoon was in progress over both the Arabian Sea and the Bay of Bengal, and rain was falling in Malabar, the interior of the Peninsula, Burma, Assam and north Bengal. The Arabian Sea current travelled up the west coast with its usual rapidity and gave the first burst of monsoon rainfall to Bombay on the 4th, Surat on the 5th, Kathiawar on the 8th, the Central Provinces West on the 7th and the Central Provinces East on the 9th. The Bay current on the other hand penetrated inland with great rapidity, and by the morning of the 3rd had carried rain well into the Punjab, where ordinarily the first fall of the rainy season occurs near the end of June. A depression appeared over the south-west of the Bay on the 4th and after travelling northwards disappeared off the Orissa coast on the 10th. Although only faintly marked it had the effect of restricting the activity of the Bay monsoon to Burma and north-east India. During the next two days rainfall occurred chiefly in the north of the Peninsula, Burma and north-east India, but on the 13th two disturbances appeared, one over Bengal and the other over the Arabian Sea off Kathiawar; the former advanced in a north-westerly direction and disappeared over Rajputana on the 16th after giving heavy rainfall there; the latter also followed a north-westerly course and was dissipated over the Gulf of Oman on the 15th. The disappearance of the disturbances was followed by a diversion of the Arabian Sea monsoon from the Peninsula into the United Provinces, the Punjab, the North-West Frontier Province and Kashmir. On the 21st the distribution of pressure changed to the type characteristic of a break, and during the next four days but little rain fell outside of Burma, north-east India and the west coast of the Peninsula. A revival of the monsoon over the central parts of the country began on the 26th in connection with a depression at the head of the Bay; this crossed the Orissa coast during the 27th and moving roughly north-westwards was near Jhansi on the 30th on which day rainfall had recommenced in the submontane Punjab.

The total rainfall of the month was above the average over a large part of the country. The only areas which formed exceptions to the general excess were the Bay Islands, Sind and Baluchistan. In the areas of abundant rainfall, the excess was between 30 and 60 per cent. in Orissa, Chota Nagpur, Central India, the Central Provinces, Madras South-east and the Madras Deccan, and over 60 per cent. in the Punjab, Kashmir, the North-West Frontier Province, Rajputana and Madras Coast North. In Kashmir and Rajputana West the month's total fall was more than double the normal amount.

TABLE 15.

Sub-division.	Number of rainy days.		Rainfall.			
	Actual.	Normal.	Actual.	Normal.	Departure from normal.	Percentage departure from normal.
			"	"	"	
1. Bay Islands	15·0	19·1	9·38	17·63	— 8·25	— 47
2. Lower Burma	23·9	22·5	29·88	25·81	+ 4·07	+ 16
3. Upper Burma	10·6	10·6	7·87	7·56	+ 0·31	+ 4
4 Assam	21·5	17·7	21·09	18·06	+ 3·03	+ 17
5. Bengal	17·5	14·0	15·72	14·25	+ 1·47	+ 10
6. Orissa	14·5	10·6	12·92	8·93	+ 3·99	+ 45
7. Chota Nagpur	13·9	9·6	11·55	8·15	+ 3·40	+ 42
8. Bihar	11·1	8·6	9·28	7·80	+ 1·48	+ 19

Sub-division.	Number of rainy days.		Rainfall.			
	Actual.	Normal.	Actual.	Normal.	Departure from normal.	Percentage departure from normal.
			"	"	"	
9. United Provinces, East	7·8	5·5	6·28	4·89	+ 1·39	+ 28
10. Do. do. West	6·0	4·8	4·66	4·10	+ 0·56	+ 14
11. Punjab, East and North	4·6	2·9	3·45	2·08	+ 1·37	+ 66
12. Do., South-west	1·9	1·4	1·29	0·80	+ 0·49	+ 61
13. Kashmir	6·4	3·8	6·32	2·14	+ 4·18	+195
14. North-West Frontier Province	2·6	1·7	1·52	0·90	+ 0·62	+ 69
15. Baluchistan	0	0·5	0·01	0·25	— 0·24	— 96
16. Sind	0·1	0·7	0·31	0·52	— 0·21	— 40
17. Rajputana, West	2·7	1·9	3·05	1·26	+ 1·79	+142
18. Do., East	5·2	3·7	4·61	2·48	+ 2·13	+ 86
19. Gujarat	7·2	5·3	5·26	4·78	+ 0·48	+ 10
20. Central India, West	7·8	5·7	6·90	4·72	+ 2·18	+ 46
21. Do. do., East	7·0	4·9	6·60	4·31	+ 2·29	+ 53
22. Berar	11·0	8·0	7·89	5·67	+ 2·22	+ 39
23. Central Provinces, West	10·6	8·5	9·14	6·90	+ 2·24	+ 32
24. Do. do. East	13·4	9·5	11·32	8·43	+ 2·89	+ 34
25. Konkan	23·6	18·3	31·13	25·30	+ 5·83	+ 23
26. Bombay Deccan	10·2	8·0	6·09	5·18	+ 0·91	+ 18
27. Hyderabad, North	11·3	7·9	6·92	5·46	+ 1·46	+ 27
28. Do., South	10·2	7·0	5·29	4·31	+ 0·98	+ 23
29. Mysore	9·4	7·1	6·03	4·77	+ 1·26	+ 26
30. Malabar	27·7	23·2	38·85	33·38	+ 5·47	+ 16
31. Madras, South-east	4·6	2·9	2·45	1·53	+ 0·92	+ 60
32. Do. Deccan	6·2	4·6	3·60	2·51	+ 1·09	+ 43
33. Do. Coast, North	10·9	6·4	8·25	4·60	+ 3·65	+ 79

TABLE 16.

Division.	Rainfall.			
	Actual.	Normal.	Departure from normal.	Percentage departure from normal.
	"	"	"	
Burma	16·52	14·73	+1·79	+ 12
Assam	21·09	18·06	+3·03	+ 17
Bengal	15·72	14·25	+1·47	+ 10
Bihar and Orissa	10·75	8·17	+2·58	+ 32
United Provinces	5·40	4·47	+0·93	+ 21
Punjab	2·92	1·77	+1·15	+ 65
North-West Frontier Province	1·52	0·90	+0·62	+ 69
Sind	0·31	0·52	—0·21	— 40
Rajputana	4·13	2·10	+2·03	+ 97
Bombay	10·32	8·66	+1·66	+ 19
Central India	6·76	4·51	+2·25	+ 50
Central Provinces	9·63	7·15	+2·48	+ 35
Hyderabad	6·15	4·92	+1·23	+ 25
Mysore	6·03	4·77	+1·26	+ 26
Madras	7·62	5·46	+2·16	+ 40
Mean of India	8·82	7·06	+1·76	+ 25

Snowfall.

I.—AFGHANISTAN.

14. No snow fell on the mountains near Kabul during the month.

II.—NORTH-WEST FRONTIER PROVINCE.

(*a*) *Khyber.*—
(*b*) *Drosh.*—
(*c*) *Parachinar.*—
} No snowfall occurred in these districts.

(*d*) *Malakand.*—Light snow fell on the higher elevations of upper Swat and Lowarai.

III.—KASHMIR.

(*a*) *Gulmarg.*—There were light falls on the surrounding higher mountains on the 18th and 19th.

(*b*) *Skardu.*—Light snowfall occurred on the surrounding hills on the 1st, 2nd, 7th, 11th, 18th and 20th, and moderate snowfall on the 19th.

(*c*) *Srinagar.*—There was a light fall of snow on the highest peaks towards the north-east.

(*d*) *Dras.*—Light snow fell on the 20th on the surrounding ranges.

(*e*) *Kargil.*—About 2″ of snow fell on the Archulla and 1″ on the Nakthulla, Smenulla and Barulla mountains. The accumulation of snow at the end of the month was 5″ on the top of the Archulla and 2″ on the top of the Nakthulla.

(*f*) *Leh.*—Some snow fell, but it melted away quickly.

IV.—PUNJAB.

(*a*) *Kangra.*—There were light falls of snow at elevations over 13,000 feet in Lahul and upper Kulu.

(*b*) *Kilba (Simla Hills).*—
(*c*) *Chamba.*—
} No snow storms occurred during the month.

V.—UNITED PROVINCES.

(*a*) *Garhwal.*—Moderate snow is reported to have fallen on heights above 14,000 feet.

(*b*) *Almora.*—The total snowfall of the month was estimated at about 1½′ in Malla Danpur, 5′ in Malla Darma, 2′ in Malla Johar, 7′ in Byans and 1′ in Chaudas.

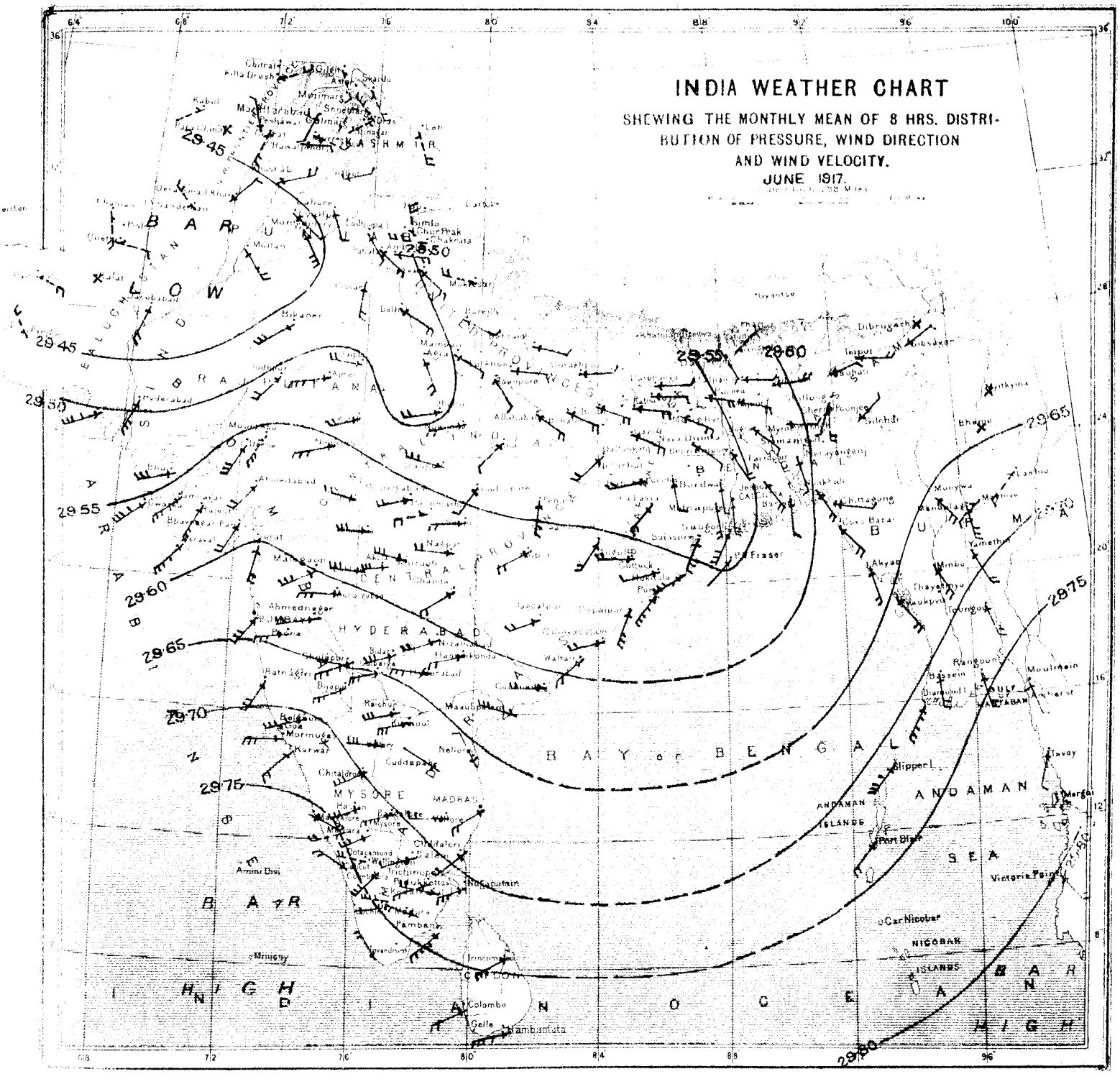
TABLE 17.

Name of pass.	Depth of accumulation at the end of the month.	
	Reported.	Normal.
	Feet.	Feet.
Binkaru pass	5	12½
Nuwe „	11	17
Pindari peak	1½	2
Kaphni „	1½	2
Puwalidwar „	1½	...
Nandakot „	1½	...
Untadhura „	6⅓	5⅓
Ralamdhura „	6½	4
Lampia „	6	8½
Lipulekh „	4	6¾

SUMMARY.

15. There were light local falls of snow such as usually occur in June but these did not affect the previous accumulations which in general continued below the average depth.

HEM RAJ.

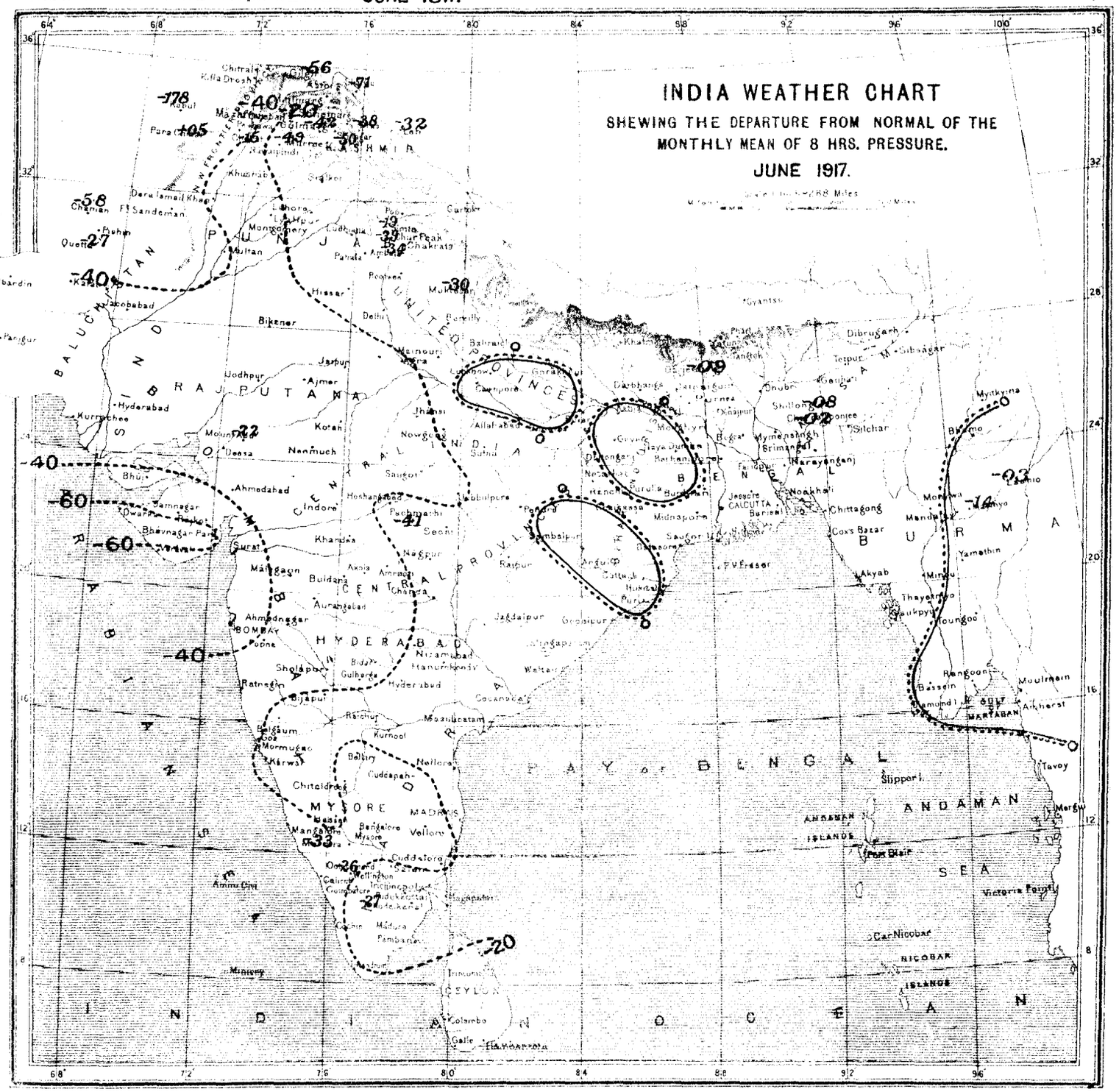


The lines of the above chart represent isobars or lines of equal barometric pressure, the numbers attached indicating the barometric pressure in inches and being drawn for differences of pressure of ·05 inch. The isobars in the Bay of Bengal are filled in by means of the shore observations, and by comparison with the normal distribution of pressure.

The mean 8 hrs. wind directions of the month are shewn by means of arrows flying with the wind, and are calculated by means of Lambert's formula applied to the winds as given in Table B of the 8 hrs. observations. The mean wind directions for the hill stations are indicated by broken arrows to distinguish them from the wind arrows for the plain stations. The mean velocity of the winds during the month is shewn by the following notation:—

Velocity of	0 to 2	miles	per	hour	...	one	feather	added	to	the	wind	arrow.
,,	,, 2 to 5	,,	,,	,,	...	two	feathers	,,	,,	,,	,,	
,,	,, 5 to 10	,,	,,	,,	...	three	,,	,,	,,	,,	,,	
,,	,, 10 to 20	,,	,,	,,	...	four	,,	,,	,,	,,	,,	
	over 20	,,	,,	,,	...	five	,,	,,	,,	,,	,,	

Wind strengths are based on factor 2·2 for the standard type of Beckley Robinson anemograph, instead of 3·0 as used for this plate up to December 1911 inclusive.



The chart shows the departure from normal of the mean during the month of 8 hrs. pressure by means of lines drawn for equal amounts of departure. The numbers are given in thousandths of an inch, 20 representing ·020′ or two hundredths of an inch, &c. Continuous lines indicate that the pressure was in excess by amounts indicated by the numbers attached to the lines, and broken or dotted lines that it was in defect by amounts indicated by the numbers attached to the lines. Two parallel lines near to each other, one continuous and the other broken or dotted, represent the line of no departure, the dotted line facing the area of deficient pressure or negative departures.

CHART SHEWING THE DEPARTURE FROM NORMAL
OF THE MONTHLY MEAN OF DAILY
MAXIMUM TEMPERATURE.

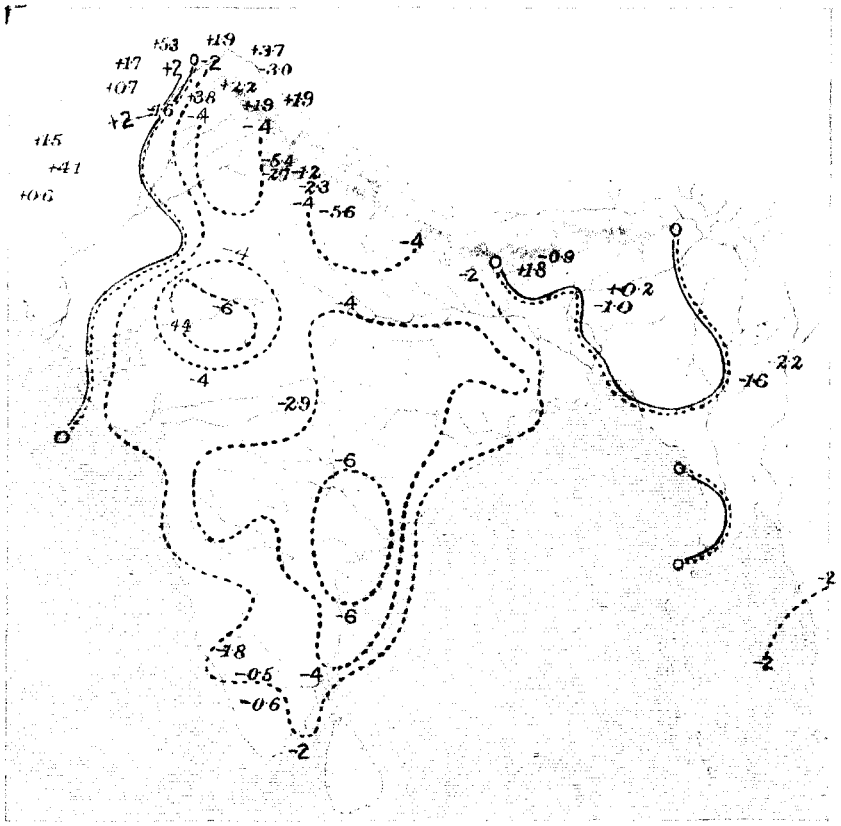


CHART SHEWING THE DEPARTURE FROM NORMAL
OF THE MONTHLY MEAN OF DAILY
MINIMUM TEMPERATURE.

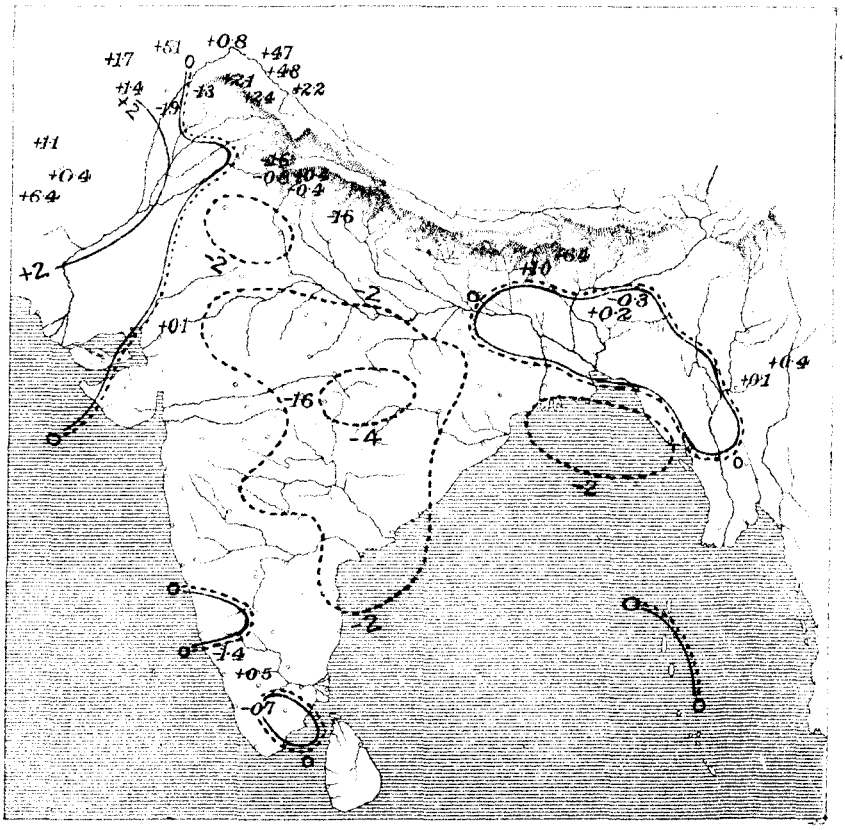


CHART SHEWING THE DEPARTURE FROM NORMAL
OF THE MONTHLY MEAN OF DAILY
MEAN TEMPERATURE.

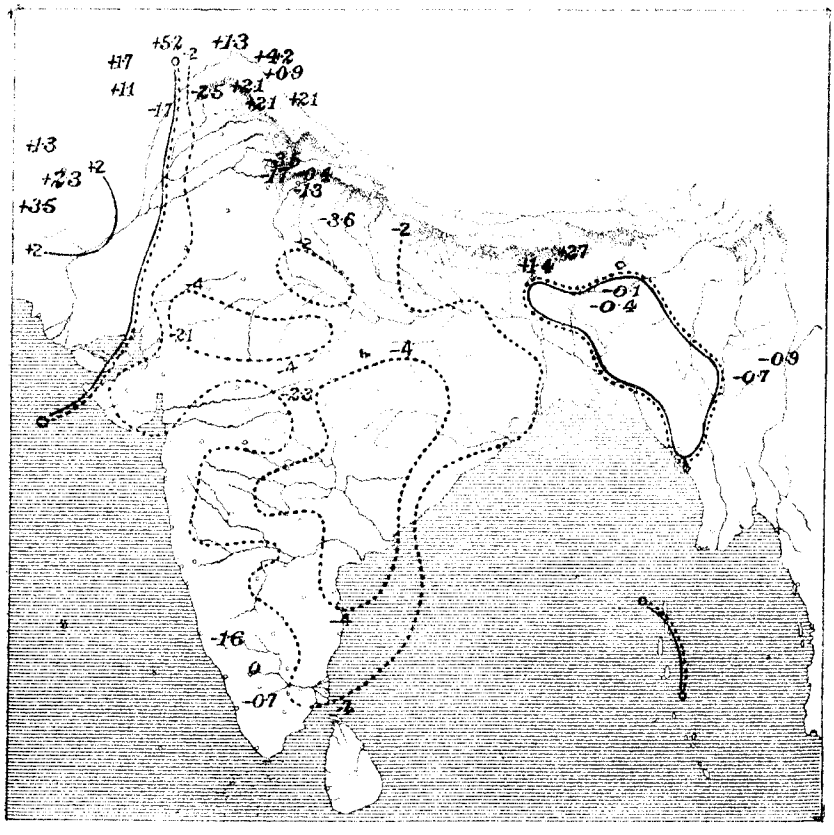


CHART SHEWING THE DEPARTURE FROM NORMAL
OF THE MONTHLY MEAN OF ABSOLUTE
HUMIDITY AT 8 HRS.

CHART SHEWING THE DEPARTURE FROM NORMAL
OF THE MONTHLY MEAN OF RELATIVE
HUMIDITY AT 8 HRS.

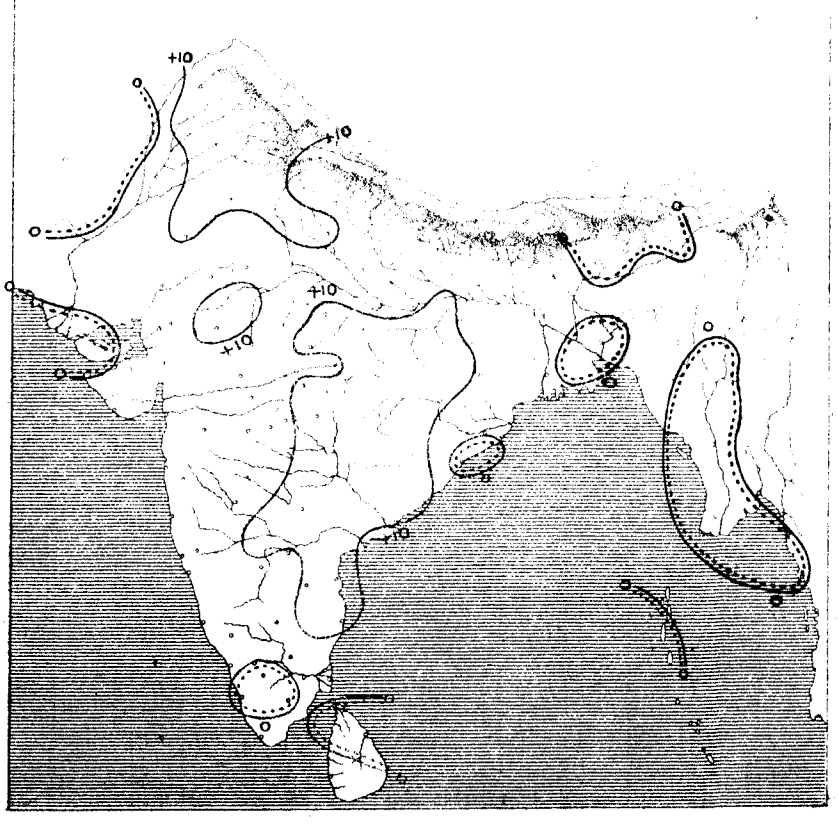


CHART SHEWING THE DEPARTURE FROM NORMAL
OF THE MONTHLY MEAN OF CLOUD
AMOUNT AT 8 HRS.

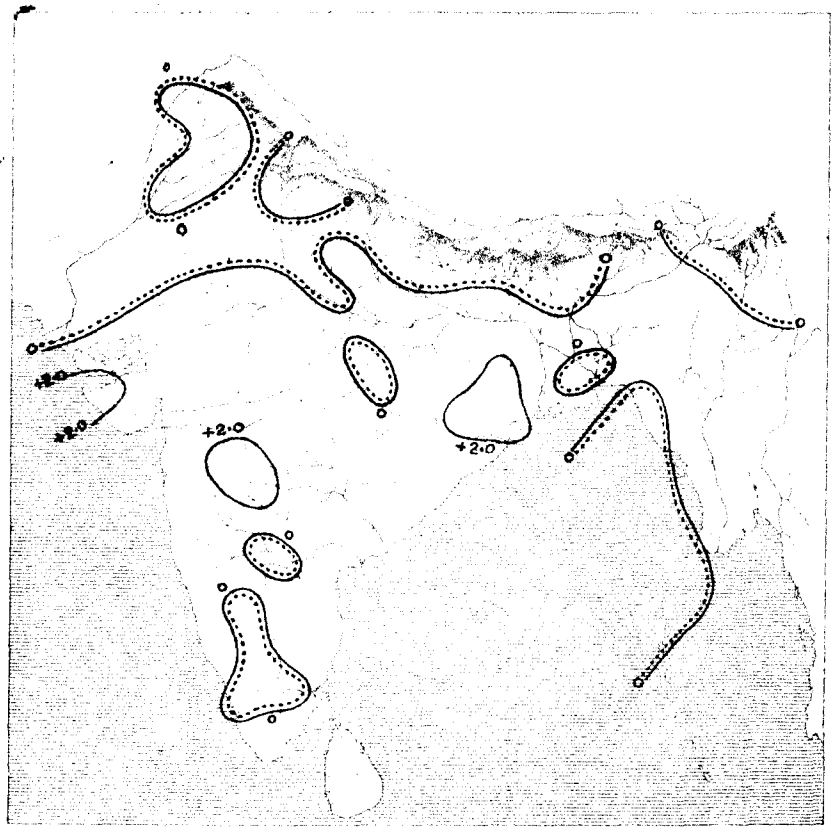
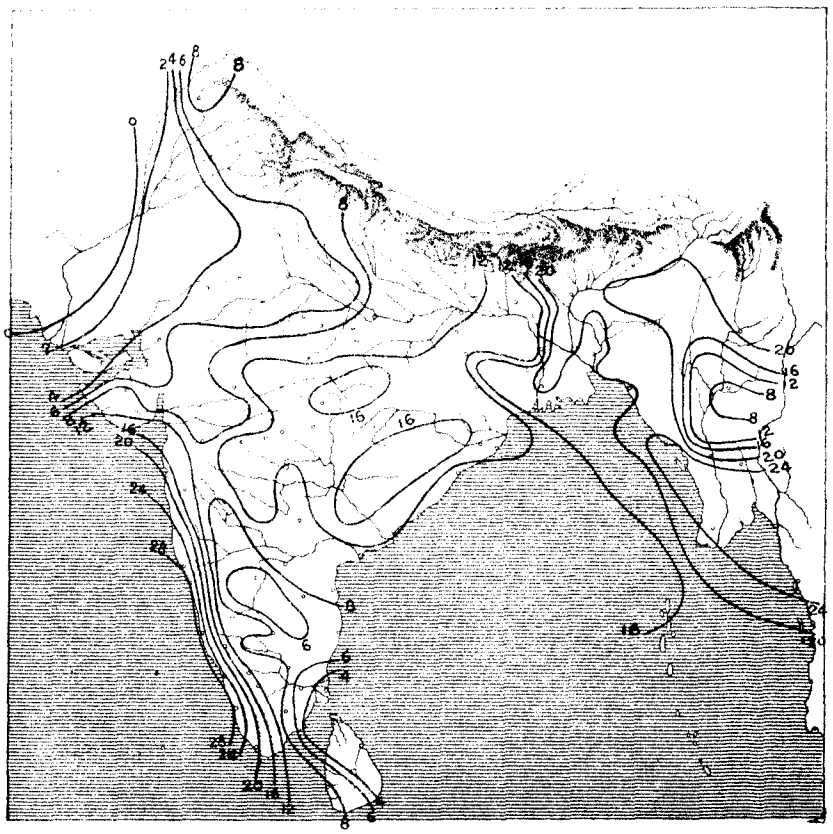
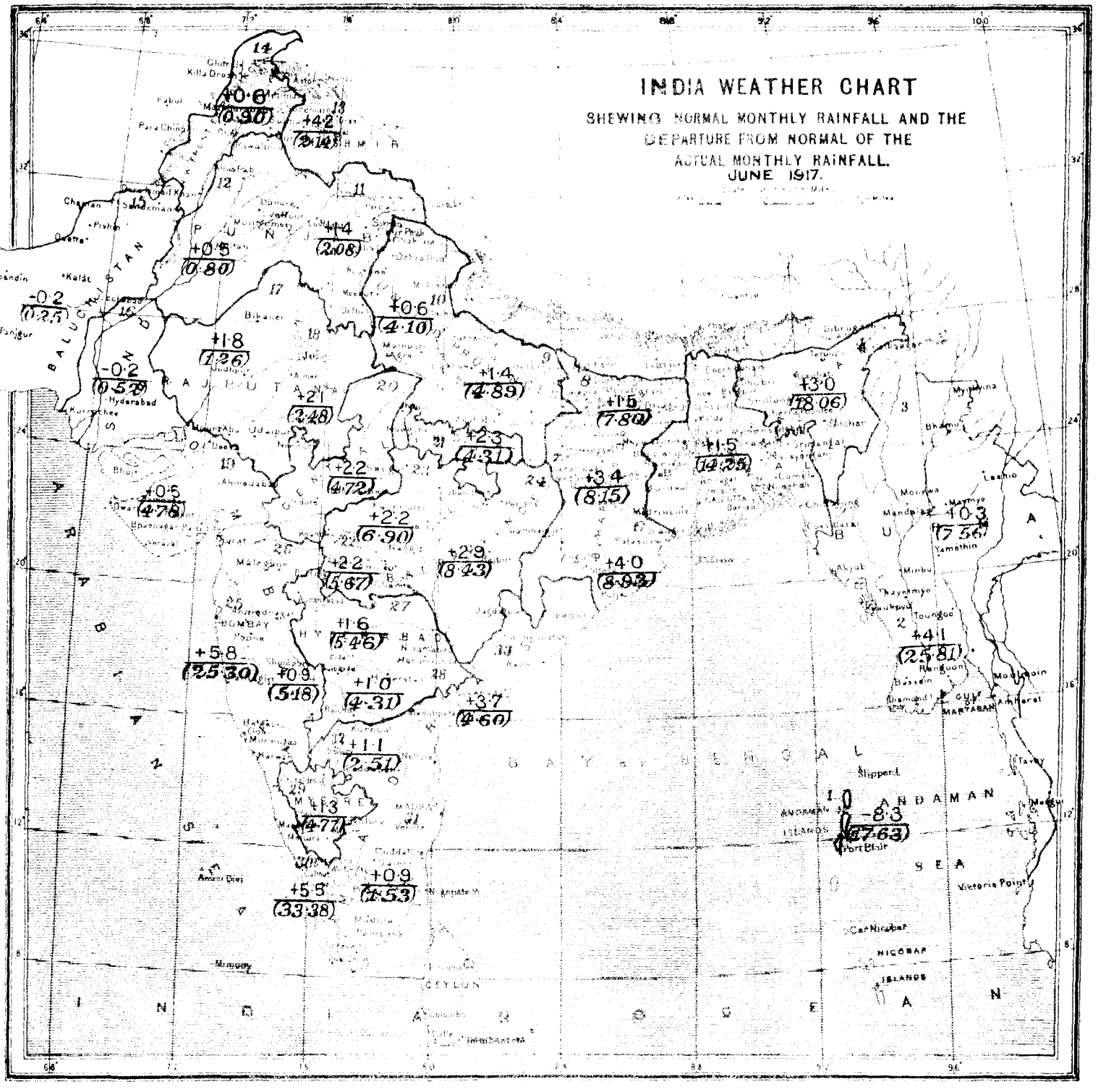


CHART SHEWING THE TOTAL NUMBER OF DAYS IN THE
MONTH ON WHICH RAINFALL EQUALLED OR
EXCEEDED 0·10 INCH.
(BASED ON THE RETURNS OF TABLE B.)





The country is divided into 33 areas as shewn in the list below. The numbers in that list correspond with the red numbers on the chart, and serve to identify the areas. The numbers in brackets on the chart give the average over the divisions of the normal monthly rainfall, the numbers above these give the departures from normal of the average actual rainfall over the divisions.

1. Bay Islands
2. Lower Burma
3. Upper Burma
4. Assam
5. Bengal
6. Orissa
7. Chota Nagpur
8. Bihar
9. United Provinces, East
10. United Provinces, West
11. Punjab, East and North
12. Do., Southwest
13. Kashmir
14. Northwest Frontier Province
15. Baluchistan
16. Sind
17. Rajputana, West
18. Rajputana, East
19. Gujerat
20. Central India, West
21. Do., East
22. Berar
23. Central Provinces, West
24. Do., East
25. Konkan
26. Bombay, Deccan
27. Hyderabad, North
28. Hyderabad, South
29. Mysore
30. Malabar
31. Madras, Southeast
32. Madras, Deccan
33. Madras Coast, North

GOVERNMENT OF INDIA

METEOROLOGICAL DEPARTMENT

MONTHLY WEATHER REVIEW

PUBLISHED BY ORDER OF

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CALCUTTA, JULY, 1917.

INTRODUCTION.

THIS review of the weather in India during the month of July, 1917, is based on observations taken daily at 8 hrs. at 218 stations, and on additional observations taken at 10 hrs. and 16 hrs. at 11 stations. In the rainfall summary the data furnished by the meteorological observatories, and the rainfall statements of the month published by the Provincial Governments have been utilized.

The brief notes on solar, magnetic and seismic disturbances are supplied by the chief observatories.

For a statement of the methods adopted in recording and tabulating the data, for each of the elements of observation, reference should be made to the introductory portion of the review for January.

Summary of the chief features of the weather in India during the month.

2. The total rainfall of the month in the plains of India was nearly normal in amount, being only 3 per cent. in defect. It was however irregularly distributed. Thus it was within 10 per cent. of the average in Burma, Assam, Bengal, Bihar and Orissa, the Central Provinces and Hyderabad; in excess by 39 per cent. in Rajputana, 18 per cent in the United Provinces, 11 per cent. in the Punjab and 24 per cent. in Central India; and deficient in the remaining divisions. The deficit exceeded 18 per cent. in the North-West Frontier Province, Sind, Bombay, Mysore and Madras.

Of climatic elements other than rainfall, humidity and temperature were in general fairly normal, while cloud amount was in considerable excess in Burma, Bihar and Orissa, the United Provinces, the Punjab, Rajputana, Central India and the Central Provinces and in defect in the North-West Frontier Province, Mysore and Madras.

Barometric pressure in the plains of India as a whole was in defect by ·024″

Solar, magnetic and seismic disturbances.

KODAIKANAL OBSERVATORY.

3. *Solar Observations.*—The weather was not favourable for solar observations during the month. The sun could not be examined for spots and faculae on three days and the prominence records were poor on a large number of days.

Sunspots.—Thirty-one new groups of spots were observed as against twenty-one in June. The daily average number was 6·7 and the average life of a spot was 6·8 days, the averages for the preceding month being 6·9 and 8·5 respectively. The distribution in latitude was as follows:—

TABLE 1.

—	0°–10°	11°—20°	21°—30°	Mean latitude.	Extreme latitudes.
North . . .	7	16	...	12°·7	5° & 18°
South . . .	1	5	2	16°·9	13° & 24°

Prominences.—Sixty large prominences were recorded during the month. The highest was 180″ and was observed on the 30th at latitude + 64° west. Only one metallic prominence was recorded.

Magnetic disturbances.—Magnetic disturbances were very prevalent during the month. There were only two calm days, the 17th and 18th. "Great" disturbances were recorded on the 2nd to 3rd, 7th, 11th to 13th, 21st to 22nd and 27th to 31st, and "moderate" disturbances on the 1st, 4th, 10th, 14th, 19th, and 23rd to 26th.

J. EVERSHED,

Director,

Kodaikanal and Madras Observatories.

Seismic records.

$\phi = 10°\ 13'\ 50''$ N ; $\lambda = 77°\ 28'\ 00''$ E ; $h = 2343$ m. *Subsoil* Rock.

Apparatus.—Milne's Horizontal Pendulum Seismograph.

TABLE 2.

	V	To	e	$\frac{r}{To^2}$
AN:				
AE:	9·76	18·1	1	2·8
AZ:				

Date.	Phase.	Time G. M. T.	Period (Sec.)	Amplitude (u) AN.	AE.	AZ.	Distance Δ (Km.)	Remarks.
1917.		h. m. s.						
July 4th	e P	0 46 48	...	...	...	...	...	
	i L	0 53 48	...	...	...	...	...	
	M	1 13 24	...	...	290	...	...	
	F	2 39 12	...	...	...	...	...	
„ 4th	e P	5 52 12	...	...	...	...	...	
	e L	5 55 12	...	...	...	...	...	
	M	6 11 18	...	...	90	...	...	
	F	6 52 36	...	...	...	...	...	
„ 4th	e P	22 20 36	...	...	...	...	...	Widening of line.
	F	22 48 06	...	...	...	...	...	
July 15th	e P	11 11 54	...	...	...	...	...	Widening of line.
	F	11 36 24	...	...	...	...	...	
„ 15th	e P	18 16 48	...	...	...	...	...	Widening of line.
	F	18 41 42	...	...	...	...	...	
„ 27th	e P	1 24 36	...	...	...	...	...	
	e L	2 23 24	...	...	...	...	...	Over lapping.
	M	2 33 06	...	...	100	...	...	
	F	.....	...	...	...	...	...	
„ 27th	P	.....	...	...	...	...	...	
	i L	4 00 54	...	...	...	...	...	
	M	4 12 36	...	...	340	...	...	
	F	5 10 00?	..	...	...	..	...	Instrument examined at 5h. 2m.
„ 29th	i P	14 52 18	...	...	...	...	...	
	i L	15 13 18	...	...	...	...	...	
	M	15 15 06	...	...	110	...	...	
	F	16 17 12	...	...	...	...	...	
„ 29-30th	i P	22 02 42	...	...	...	...	...	
	i L	22 11 24	...	...	...	...	...	
	M	22 45 36	...	...	520	...	...	
	F	1 38 12	...	...	...	...	...	
„ 31st	e P	0 05 30	...	...	...	...	...	
	i L	0 13 24	...	...	...	...	...	
	M	0 19 18	...	...	290	...	...	
	F	1 37 42	...	...	...	...	...	

T. ROYDS,

Assistant Director.

BOMBAY OBSERVATORY.

Alibag magnetic record.

4. During the month of July, 1917, the traces showed 14 calm days, 16 days of small and 1 day of moderate disturbance.

The days of the month selected as "quiet" for the purposes of the Magnetic Survey of India are the 1st, 9th, 18th, 20th and 26th.

The following table represents the magnetic character of each day during the month :—

TABLE 3.

Day.	Character.	Day.	Character.	Day.	Character.	Day.	Character.
1	C	9	C	17	C	25	C
2	S	10	S	18	C	26	C
3	S	11	S	19	C	27	S
4	S	12	S	20	C	28	S
5	C	13	S	21	S	29	S
6	C	14	S	22	S	30	S
7	S	15	C	23	C	31	M
8	S	16	C	24	C		

C.=calm ; S.=small ; M.=moderate ; G.=great ; V. G.=very great.

The mean observed absolute values of the several magnetic elements reduced to the mean monthly tabulations of the magnetograms, as also the ranges and the summed ranges of the horizontal force and the declination for the month are as follows :—

Easterly declination	0° 32′ 23″.
Horizontal force	0·36886 C.G.S. unit.
Vertical force	0·16893 C.G.S. „
Inclination	24° 36′·4.
Horizontal force range	0·00065 C.G.S. unit.
Horizontal force summed range	0·00451 C.G.S. „
Declination range	4′·8.
Declination summed range	22′·0.

(NOTE.—Summed range means sum without regard to signs of 24 ordinates of the diurnal inequality.)

Seismic records.

$\phi = 18^\circ\ 53'\ 36''$ N; $\lambda = 72^\circ\ 48'\ 56''$ E; $h = 11$m. *Subsoil* Trap

Apparatus.—Milne's Horizontal Pendulum Seismograph.

TABLE 4.

	V	To	ϵ	$\frac{r}{To^2}$
AN:				
AE:	9	19		
AZ:				

Date.	Phase.	Time G. M. T.	Period (Sec.)	Amplitude (u) An.	Amplitude (u) Ae.	Amplitude (u) Az.	Distance Δ (Km.)	Remarks.
1917.		h. m. s.						
July 1st	...	7 16 0	...	...	...	...	...	Thickening of line.
„ 4th	P	0 47 51	...	...	...	...	...	
	M	1 11 3	...	...	211	...	...	
	F	2 12 21	...	...	...	...	...	
„ 4th	P	...	...	...	...	...	...	Beginning mixed in tremors.
	M	6 12 15	...	...	67	...	...	
	F	6 40 21	...	...	...	...	...	
„ 4th	...	21 36 0 to 41 0	...	...	...	...	...	Thickening of line.
„ 4th	...	22 16 50	...	...	...	...	...	
	M	22 22 38	...	...	44	...	...	
	F	22 42 14	...	...	...	...	...	
„ 9th	...	2 32 0	...	...	...	...	...	Thickening of line.
„ 10th	...	20 25 0 to 29 0	...	...	...	...	...	Ditto.
„ 12th	P	5 10 38	...	...	...	...	...	
	M	5 22 48	...	...	56	...	...	
	F	5 39 46	...	...	...	...	...	
„ 23rd	...	18 2 0 to 6 0	...	...	...	...	...	Thickening of line.
„ 25th	P	3 42 33	...	...	...	...	...	
	M	4 20 10	...	...	56	...	...	
	F	5 4 40	...	...	...	...	...	
„ 27th	P	...	...	...	...	...	...	Beginning mixed in tremors.
	M	4 10 31	...	...	556	...	...	
	F	5 46 31	...	...	...	...	...	
„ 29th	P	...	...	...	...	...	...	Beginning lost in shifting time.
	M	15 13 12	...	...	167	...	...	
	F	16 2 49	...	...	...	...	...	
„ 29th	P	21 57 33	...	...	...	...	...	
	M	22 48 43	...	...	278	...	...	
	F	...	...	...	...	...	...	End mixed in tremors.
„ 31st	P	0 3 42	...	...	...	...	...	
	M	0 14 16	...	...	467	...	...	
	F	1 17 26	...	...	...	...	...	

Date.	Phase.	Time G. M. T.	Period (Sec.)	Amplitude (u) An.	Ae.	Az.	Distance Δ (Km.)	Remarks.
1917.		h. m. s.						
July 31st	P	3 32 15	...	...	...	...	...	
	M	3 44 3	...	...	100	...	...	
	F	4 28 20	...	...	...	...	...	
„ 31st	...	7 { 14 0 to 19 0 }	...	...	...	...	...	Thickening of line.

Sensibility to tilt 1·0 mm. of amplitude on the trace = 0″·32.

N. A. F. MOOS,
Director,
Bombay and Alibag Observatories.

5.—CALCUTTA (ALIPORE) OBSERVATORY.

Seismic records.

$\phi = 22° 32' N$; $\lambda = 88° 20' E$; $h = 6{\cdot}4m$. *Subsoil Alluvial.*

Apparatus.—Two Omori Ewing Horizontal Pendulum Seismographs.

TABLE 5.

	V	To	ϵ	$\frac{r}{To^2}$
AN:	29	18	1	
AE:	29	42	1	
AZ:				

Date.	Phase.	Time G. M. T.	Period (Sec.).	Amplitude (u). An.	Ae.	Az.	Distance Δ (Km.).	Remarks.
1917.		h. m. s.						
July 4th	P	0 45 24	5	...	...	...	...	
	S	0 50 54	13	...	...	...	...	
	L	0 58 54	16	...	...	...	...	
	M	1 1 6	...	862	...	...	...	
	F	1 32 54	...	...	...	...	...	
„ 4th	P	5 43 42	3	...	...	...	...	
	S	5 49 0	9	...	...	...	...	
	L	5 56 6	17	...	...	...	...	
	M	6 0 0	...	138	103	...	...	
	F	6 23 18	...	...	...	...	...	
July 4th	P	22 11 48	4	...	...	...	...	
	S	22 14 54	7	...	...	...	...	
	L	22 17 54	11	...	...	...	...	
	M	22 22 42	...	241	...	...	...	
	F	22 43 54	...	...	...	...	...	
„ 29th	P	14 41 48	4	...	...	...	...	
	S	14 48 48	6	...	...	...	...	
	L	15 1 36	16	...	...	...	...	
	F	15 26 48	...	...	...	...	...	
„ 29th	P	22 3 0	5	...	...	...	...	
	S	22 6 48	6	...	...	...	...	
	L	22 11 0	17	...	...	...	...	
	M	22 11 36	...	448	...	...	...	
	F	23 10 36	...	...	...	...	...	
„ 30th	P	2 33 48	?	...	...	...	...	
	S	2 34 36	?	...	...	...	...	
	F	2 0 24	...	...	...	...	...	
„ 30th	P	23 58 6	6	...	...	...	...	
„ 31st	S	0 0 42	14	...	...	...	...	
	L	0 3 18	?	...	...	...	...	
	M	Pen went off the drum.		...	...	...	...	
	F	Do.		...	...	...	...	

6.—SIMLA OBSERVATORY.

Seismic records.

$\phi = 31° 6' N$; $\lambda = 77° 11' E$; $h = 2433{\cdot}5\ m$. *Subsoil* Rock.

Apparatus.—Two Omori-Ewing Horizontal Pendulum Seismographs (masses 50 kg.)

TABLE 6.

	V	To	ϵ	$\frac{r}{To^2}$
AN:	14	45	1	
AE:	14	45	1	
AZ:				

Date.	Phase.	Time G. M. T.	Period (Sec.)	Amplitude (a). An.	Ae.	Az.	Distance. Δ (Km.)	Remarks.
1917.		h. m. s.						
July 4th	P	0 46 12	...	...	...	...	...	
	S	0 52 30	.	..	...	...	...	
	L	0 59 12	...	...		...	...	
	M	1 1 48	42	2679	...	...	...	Pendulum struck against stop on one side.
	M	1 3 30	24	...	393	...	...	
	F	2 15 6	...	...	...	...	...	
„ 4th	e	5 50 48	...	...	...	...	...	
	M	6 1 24	...	111	...	...	...	
	M	6 3 48	...	...	43	...	...	
	F	6 42 42	...	.	..	...	...	Tremors.
„ 4th	e	22 18 0	...	..	...	...	...	
	F	22 39 6	...	...	...	...	...	Slight tremors. Instrument dismantled on the 12th July and set up in a new building on October 1st, 1917.

The following table contains a list of earthquakes that were reported :—

TABLE 7.

Place at which felt.	Date.	G. M. T. of earthquake.	Duration.	Intensity Rossi-Forel scale.	No. of shocks.	Remarks.
		h. m.	Sec.			
Kabul (Afghanistan) .	July 4th	0 59	3	4	2	
„ „ .	„ 4th	20 14	4	4	1	
Drosh . . .	„ 4th	1 5	5	7	1	
Gulmarg (Kashmir) .	„ 4th	1 17	45	6	1	
Srinagar . . .	„ 4th	1 22	12	6	1	
Mandalay . . .	„ 9th	7 55	3	3	3	
Abadan (Persia) . .	„ 10th	17 40	30	?	1	
Lahore . . .	„ 14th	19 18	20	6	2	
Kabul (Afghanistan) .	„ 14th	23 24	?	5	3	
Drosh . . .	„ 14th	23 45	7	7	2	
Abadan (Persia) . .	„ 15th	17 20	10	?	1	
„ „ . .	„ 15th	17 25	?	?	1	
Mohammerah (Persia) .	„ 15th	17 34	?	?	1	
„ „ .	„ 15th	17 39	?	?	1	
Salonah (Nowgong, Assam).	„ 30th	2 21	8	6	1	
Shillong . . .	„ 30th	2 33	1	5	1	

Solar radiation.—Observations not recorded owing to the absence of officers on war service.

C. W. B. NORMAND,
Imperial Meteorologist, Simla.

Weather in the Indian Ocean.

7. Barometric pressure was in decided defect at all the three representative stations. Winds were fairly normal as regards direction, but were stronger than usual. Rainfall was largely below normal at Zanzibar and about the average at Seychelles and Mauritius. The general conditions in the Indian Ocean were thus favourable for the prospects of Indian monsoon rainfall in August.

TABLE 8.

——	Mauritius.*	Zanzibar.	Seychelles.
Departure from normal of mean pressure	—·051	– ·043	—·069
Actual mean wind direction . .	S 65° E	S 20° W	S 38° E
Normal mean wind direction . .	S 65° E	S 15° W	S 33° E
Actual mean wind velocity (miles per diem).	296	151	250
Normal mean wind velocity (miles per diem).	263	144	211
Rainfall departure from normal . .	—0·13	—1·55	+ 0·24

* Based on weekly telegrams.

Depressions and cyclonic storms.

8. No important depressions or storms affected the weather in the Indian region during the month.

Pressure.

9. Atmospheric pressure was nearly normal in Hyderabad, the Bombay Deccan and the east of Gujarat, and was lower than usual over the rest of India; the deficiency however was generally small and amounted to a twentieth of an inch in the North-West Frontier Province only.

The vertical distribution was on the whole very nearly normal. The monsoon trough of low pressure occupied its average position.

TABLE 9.

DIVISION.	Departure from normal of mean 8 hrs. pressure.
	"
Burma	—·032
Assam	—·029
Bengal	—·032
Bihar and Orissa	—·027
United Provinces	—·031
Punjab	—·036
North-West Frontier Province	—·051
Sind	—·030
Rajputana	—·023
Bombay	—·009
Central India	—·021
Central Provinces	—·020
Hyderabad	—·004
Mysore	—·011
Madras	—·022

TABLE 10.

HILL STATION.	Departure from normal pressure. A	PLAIN STATION.	Departure from normal pressure. B	Departure of pressure difference. B—A.
	"		"	"
Quetta	—·018	Jacobabad	—·038	—·020
Leh	—·021	Lahore	—·037	—·016
Murree	—·055	Peshawar	—·061	—·006
Simla	—·025	Ludhiana	—·023	+·002
Darjiling	—·027	Dhubri	—·025	+·002
Mount Abu	—·019	Deesa	—·001	+·018
Pachmarhi	—·038	Khandwa	—·011	+·027
Kodaikanal	—·010	Madura	—·027	—·017

Temperature.

10. Maximum temperature was below the average by 4½° in Rajputana and by 3° in Central India and the sub-montane districts of the Punjab, and was sensibly normal over the rest of the country. Minimum temperature was within 2° of the normal in all the sub-divisions with the exception of Rajputana West, where it was 2½° lower than usual.

TABLE 11.

SUB-DIVISION.	ACTUAL TEMPERATURE.				DEPARTURE FROM NORMAL OF		
	Mean maximum.	Mean minimum.	Monthly mean of mean between maximum and minimum	Mean daily range of temperature.	Maximum.	Minimum.	Daily range.
	°	°	°	°	°	°	°
1. Bay Islands	84·1	77·0	80·6	7·1	—1·1	—0·3	—0·8
2. Lower Burma	84·0	74·6	79·3	9·3	+0·1	—0·3	+0·4
3. Upper Burma	89·7	76·1	82·9	13·6	—0·4	+0·3	—0·7
4. Assam	88·3	77·3	82·8	11·0	—0·7	0	—0·7
5. Bengal	87·6	78·3	83·0	9·3	—0·5	0	—0·5
6. Orissa	87·8	78·4	83·1	9·4	—0·6	+0·1	—0·7
7. Chota Nagpur	88·1	76·7	82·4	11·3	—1·1	+0·4	—1·5

Sub-division.	Actual temperature.				Departure from normal of		
	Mean maximum.	Mean minimum.	Monthly mean of mean between maximum and minimum	Mean daily range of temperature.	Maximum.	Minimum.	Daily range.
	°	°	°	°	°	°	°
8. Bihar	89·3	79·1	84·2	10·1	—1·3	+0·2	—1·5
9. United Provinces, East	90·1	79·3	84·7	10·8	—2·2	—0·2	—2·0
10. Do. do., West	90·7	78·7	84·7	12·0	—2·3	—0·8	—1·5
11. Punjab, East and North	95·9	79·2	87·5	16·6	—1·3	—0·5	—0·8
12. Do., South-west	102·0	82·8	92·4	19·2	—1·4	—0·3	—1·1
13. Kashmir	83·5	61·2	72·4	22·3	—0·1	+1·5	—1·6
14. North-West Frontier Province	104·9	81·9	93·5	23·0	0	+0·8	—0·8
15. Baluchistan	100·4	70·5	85·4	29·9	+1·5	—1·5	+3·0
16. Sind	99·5	83·3	91·3	16·2	+0·9	+1·3	—0·4
17. Rajputana, West	96·5	79·4	87·9	17·1	—2·9	—2·4	—0·5
18. Do., East	88·3	77·1	82·7	11·1	—5·5	—1·9	—3·6
19. Gujarat	88·8	78·2	83·6	10·6	—0·9	—0·1	—0·8
20. Central India, West	83·7	73·3	78·5	10·3	—2·9	—0·2	—2·7
21. Do. do., East	86·4	77·1	81·7	9·3	—3·1	—0·9	—2·2
22. Berar	85·2	73·0	79·1	12·2	—1·7	0	—1·7
23. Central Provinces, West	84·8	73·6	79·2	11·2	—1·9	—0·5	—1·4
24. Do. do., East	84·9	73·5	79·2	11·3	—1·1	+0·1	—1·2
25. Konkan	84·3	76·6	80·4	7·7	+0·5	+0·4	+0·1
26. Bombay Deccan	86·3	70·9	78·6	15·4	+1·4	0	+1·4
27. Hyderabad, North	86·2	70·9	78·5	15·2	—0·8	0	—0·8
28. Do., South	88·7	73·2	81·0	15·5	—0·1	—0·3	+0·2
29. Mysore	82·9	66·8	74·9	16·1	+2·0	+0·1	+1·9
30. Malabar	84·0	74·8	79·4	9·2	+1·1	+0·7	+0·4
31. Madras, South-east	94·5	77·5	86·0	17·0	+0·5	+0·8	—0·3
32. Do. Deccan	93·7	76·3	85·0	17·4	+0·9	+0·4	+0·5
33. Do. Coast, North	90·8	78·8	84·8	12·0	—0·4	+0·1	—0·5

TABLE 12.

Division.	Departure from normal of		
	Mean maximum temperature.	Mean minimum temperature.	Mean temperature.
	°	°	°
Burma	—0·1	0	—0·1
Assam	—0·7	0	—0·3
Bengal	—0·5	0	—0·2
Bihar and Orissa	—1·0	+0·2	—0·4
United Provinces	—2·2	—0·5	—1·3
Punjab	—1·3	—0·5	—0·9
North-West Frontier Province	0	+0·8	+0·4

Division.	Departure from normal of		
	Mean maximum temperature.	Mean minimum temperature.	Mean temperature.
	°	°	°
Sind	+0·9	+1·3	+1·1
Rajputana	—4·4	—2·1	—3·3
Bombay	+0·1	+0·1	+0·1
Central India	—2·9	—0·5	—1·7
Central Provinces	—1·7	—0·2	—0·9
Hyderabad	—0·4	—0·1	—0·3
Mysore	+2·0	+0·1	+1·1
Madras	+0·5	+0·5	+0·5

Winds.

11. The monsoon currents were of about the usual strength, but prevailed with great steadiness from the usual directions.

TABLE 13.

DIVISION.	DEPARTURE FROM NORMAL OF	
	Hourly wind velocity.	Wind steadiness.
Burma	+1·1	+ 1
Assam	+0·3	+10
Bengal	—1·0	— 8
Bihar and Orissa	—0·4	0
United Provinces	—0·6	+10
Punjab	+0·2	+ 5
North-West Frontier Province	—1·0	—10
Sind	—0·9	+13
Rajputana	+1·1	+20
Bombay	—0·9	+ 7
Central India	+0·1	+10
Central Provinces	+0·7	+ 9
Hyderabad	—1·8	+ 9
Mysore	+0·8	— 4
Madras	+0·3	+ 3

Humidity and Cloud.

12. The hygrometric conditions did not differ to any appreciable extent from the normal.

Over the greater part of the country there was more cloud than usual; the important exceptions were the interior of Sind, Mysore, the Madras Deccan and Malabar, where skies were unusually clear.

TABLE 14.

DIVISION.	HYGROMETRY; 8 HRS.				CLOUD.	
	Mean humidity.	Departure from normal.	Mean vapour tension in inches of mercury.	Departure from normal in inches of mercury.	Mean cloud amount at 8 hrs.	Departure from normal.
	%					
Burma	90	+ 1	·871	—·011	8·6	+0·5
Assam	91	+ 1	·940	—·003	8·0	+0·2
Bengal	90	+ 1	·961	—·002	8·2	+0·5
Bihar and Orissa	83	+ 2	·946	+·019	8·1	+0·9
United Provinces	85	+ 3	·944	+·016	7·1	+0·6
Punjab	74	+ 3	·889	+·030	4·6	+0·5
North-West Frontier Province.	65	— 2	·876	—·032	2·3	—0·4
Sind	72	0	·903	+·004	4·0	0
Rajputana	77	+ 5	·816	—·014	6·7	+0·9
Bombay	82	— 1	·832	—·007	8·0	+0·1
Central India	87	+ 4	·831	—·002	8·7	+0·7
Central Provinces	85	+ 1	·784	—·013	8·6	+1·0
Hyderabad	81	+ 2	·726	—·001	7·6	—0·1
Mysore	81	— 3	·618	—·021	7·3	—1·6
Madras	75	— 1	·801	—·002	6·7	—0·4

Rainfall.

13. The total rainfall of the month in the plains of India was nearly normal in amount, but its geographical distribution differed somewhat from the usual type: thus while there was an excess in the United Provinces, the Punjab East and North, Rajputana, Central India and Hyderabad North, the rainfall was in defect in the Bay Islands, Upper Burma, the North-West Frontier Province, Gujarat, Sind, the Konkan, the Bombay Deccan, Mysore and the greater part of the Madras Presidency. The deficiency was upwards of 50 per cent. in Sind, and ranged between 30 and 50 per cent. in Upper Burma, the Konkan, the Bombay Deccan, Mysore, Malabar and the Madras Deccan.

In Kashmir there was an excess of 12 per cent. while in Baluchistan the actual fall was no less than 58 per cent. short of the normal.

TABLE 15.

SUB-DIVISION.	NUMBER OF RAINY DAYS.		RAINFALL.			
	Actual.	Normal.	Actual.	Normal.	Departure from normal.	Percentage departure from normal.
			"	"	"	
1. Bay Islands	20·5	18·6	12·08	14·79	—2·71	— 18
2. Lower Burma	25·3	25·0	31·10	30·86	+0·24	+ 1
3. Upper Burma	7·7	9·6	4·50	6·52	—2·02	— 31
4. Assam	21·4	19·0	18·38	18·06	+0·32	+ 2
5. Bengal	18·9	16·9	16·51	15·57	+0·94	+ 6
6. Orissa	17·0	15·5	12·26	12·94	—0·68	— 5
7. Chota Nagpur	16·2	15·9	12·72	13·26	—0·54	— 4
8. Bihar	15·7	14·0	13·38	12·53	+0·85	+ 7
9. United Provinces, East	14·6	12·6	13·24	11·57	+1·67	+ 14
10. Do. do., West	14·1	11·7	14·28	11·86	+2·42	+ 20
11. Punjab, East and North	7·6	6·8	7·14	6·30	+0·84	+ 13
12. Do., South-west	3·6	3·1	2·37	2·45	—0·08	— 3
13. Kashmir	7·1	7·6	7·68	6·88	+0·80	+ 12
14. North-West Frontier Province	3·3	4·1	2·42	3·00	—0·58	— 19
15. Baluchistan	0·7	1·4	0·35	0·83	—0·48	— 58
16. Sind	0·6	2·7	0·88	2·55	—1·67	— 65
17. Rajputana, West	4·4	5·0	4·41	3·89	+0·52	+ 13
18. Do., East	12·7	9·8	12·18	8·48	+3·70	+ 44
19. Gujarat	10·9	12·9	11·29	13·48	—2·19	— 16
20. Central India, West	14·4	12·6	11·92	10·82	+1·10	+ 10
21. Do., East	14·9	12·6	15·71	12·05	+3·66	+ 30
22. Berar	13·5	12·2	8·84	9·42	—0·58	— 6
23. Central Provinces, West	15·7	15·1	12·84	14·02	—1·18	— 8
24. Do., East	17·1	16·5	15·42	15·48	—0·06	0
25. Konkan	26·0	26·4	27·11	40·55	—13·44	— 33
26. Bombay Deccan	8·4	11·5	4·02	8·00	—3·98	— 50
27. Hyderabad, North	12·6	12·0	9·37	8·09	+1·28	+ 16
28. Do., South	11·8	10·3	5·95	6·05	—0·10	— 2
29. Mysore	6·8	9·7	3·69	7·14	—3·45	— 48
30. Malabar	19·8	27·1	20·89	38·68	—17·79	— 46
31. Madras, South-east	3·2	3·6	1·72	1·94	—0·22	— 11
32. Do., Deccan	5·0	6·2	1·85	3·08	—1·23	— 40
33. Do., Coast, North	9·5	10·0	6·09	6·48	—0·39	— 6

TABLE 16.

DIVISION.	RAINFALL.			
	Actual.	Normal.	Departure from normal.	Percentage departure from normal.
	"	"	"	
Burma	14·95	16·08	—1·13	— 7
Assam	18·38	18·06	+0·32	+ 2
Bengal	16·51	15·57	+0·94	+ 6
Bihar and Orissa	12·94	12·81	+0·13	+ 1
United Provinces	13·81	11·73	+2·08	+18
Punjab	5·97	5·36	+0·61	+11
North-West Frontier Province	2·42	3·00	—0·58	—19
Sind	0·88	2·55	—1·67	—65
Rajputana	9·86	7·10	+2·76	+39
Bombay	10·51	15·61	—5·10	—33
Central India	14·19	11·43	+2·76	+24
Central Provinces	12·72	13·30	—0·58	— 4
Hyderabad	7·75	7·12	+0·63	+ 9
Mysore	3·69	7·14	—3·45	—48
Madras	4·77	6·77	—2·00	—30
Mean of India	10·68	10·99	—0·31	— 3

Snowfall.

I.—AFGHANISTAN.

14. During the first fortnight for which alone information is forthcoming there was no snowfall on the ranges in the Kabul district, and the unmelted residue of the previous accumulations on the Paghman and Hindu Kush ranges was of about the usual depth.

II.—NORTH-WEST FRONTIER PROVINCE.

(*a*) *Parachinar.*—On the adjoining ranges there were no snowstorms and the previous accumulations had almost disappeared.

(*b*) *Drosh.*—On the surrounding hills no snowstorms occurred. The accumulations existing at the end of the month were below the average.

(*c*) *Khyber.*—There was no snowfall in this agency.

(*d*) *Malakand.*—Slight snow fell on the higher mountains of upper Swat and on the Lowarai but it melted away quickly.

(*e*) *Hazara.*—No accumulation of snow existed at the end of the month on the mountain ranges and passes in this district.

III.—KASHMIR.

No snowfall occurred during the month except on the high ranges near Skardu where snowstorms were observed on the 11th, 12th and 18th. The ranges around Kargil had become clear of snow by the end of the month; no information is available about the accumulation elsewhere.

IV.—PUNJAB.

(*a*) *Chamba.*—No snowfall was observed during the first 26 days of the month; the accumulations due to previous falls, however, extended down to slightly lower levels than usual.

(*b*) *Kulu.*—There were light falls of snow at elevations over 13,000 feet in Lahul and Upper Kulu but the accumulations were below normal; on the Sirikand pass (18,459′) the depth of snow at the end of the month was only 1′ against a normal of 2′.

(*c*) *Kilba (Simla Hills.)*—No snowstorms occurred, and at the end of the month there was no accumulation below 15,000 feet except in the ravines where snow was lying in two places even at an elevation of 9,000 feet.

V.—UNITED PROVINCES.

(*a*) *Garhwal.*—Some snow fell at all heights above 14,000 feet. The accumulations existing at the end of the month were greater than on the corresponding date of the previous year.

(*b*) *Almora.*—During the month snow fell to a depth of 4¾′ at Malla Darma, 7′ at Byans, ½′ at Mallas Johar and Danpur and 1′ at Chaudas. The snow line came down from the perpetual snows to a distance of 3 miles in Byans, 1½ miles in Malla Darma and ¼ mile in Chaudas.

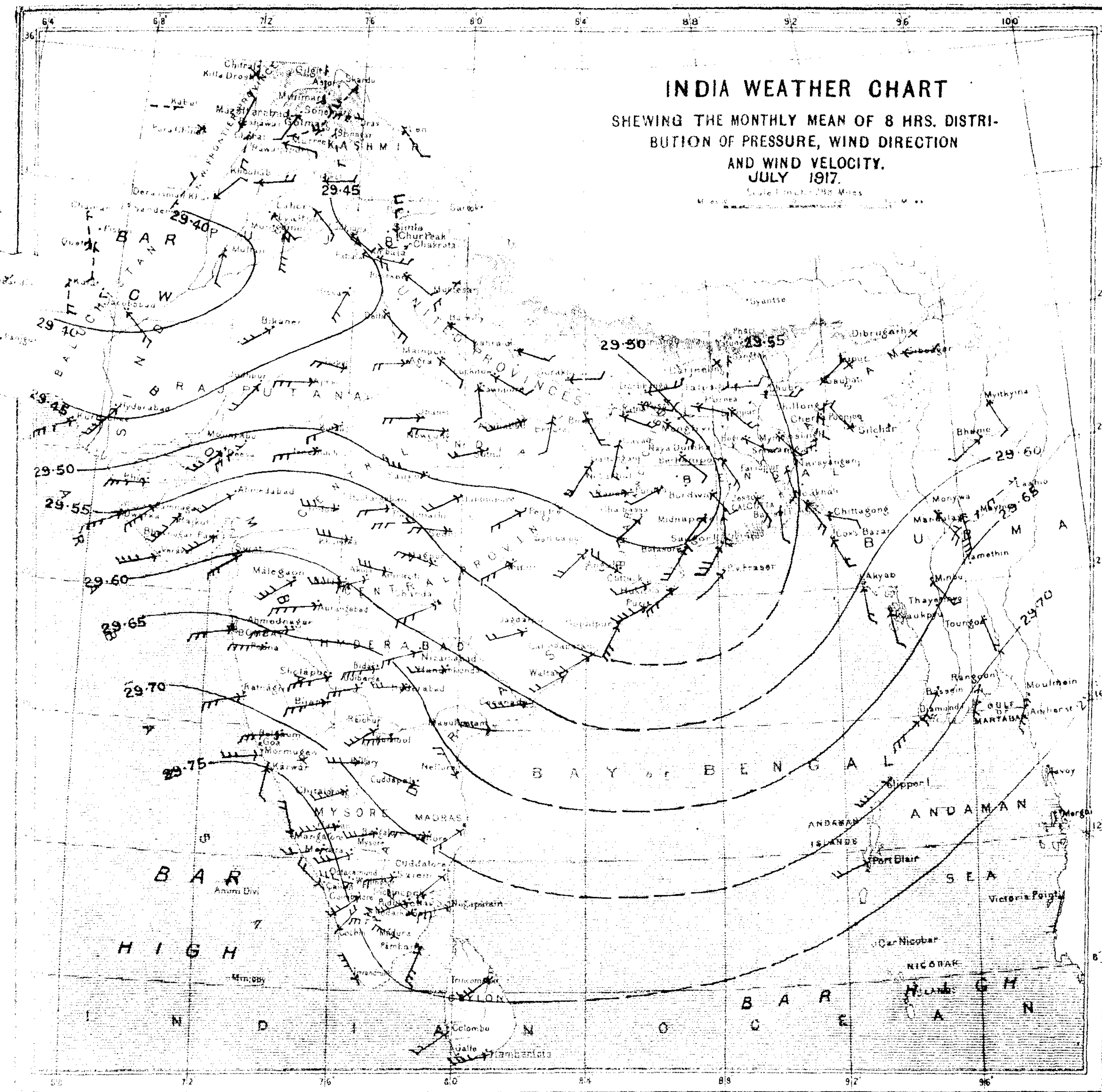
TABLE 17.

NAME OF PASS OR PEAK.	DEPTH OF ACCUMULATION AT THE END OF THE MONTH.	
	Reported.	Normal.
	Feet.	Feet.
Nuwe pass	11½	14
Lampia "	4	3¾
Lipulekh "	2	3
Pindari peak	½	½
Kaphini "	½	½
Binkaru pass	2½	6½
Untadhura "	½	5¾
Ralamdhura "	½	4
Puwalidwar "	½	?
Nandakot "	½	?

SUMMARY.

15. There was but little snowfall and the accumulations existing at the end of the month were on the whole of less than the average depth.

HEM RAJ.

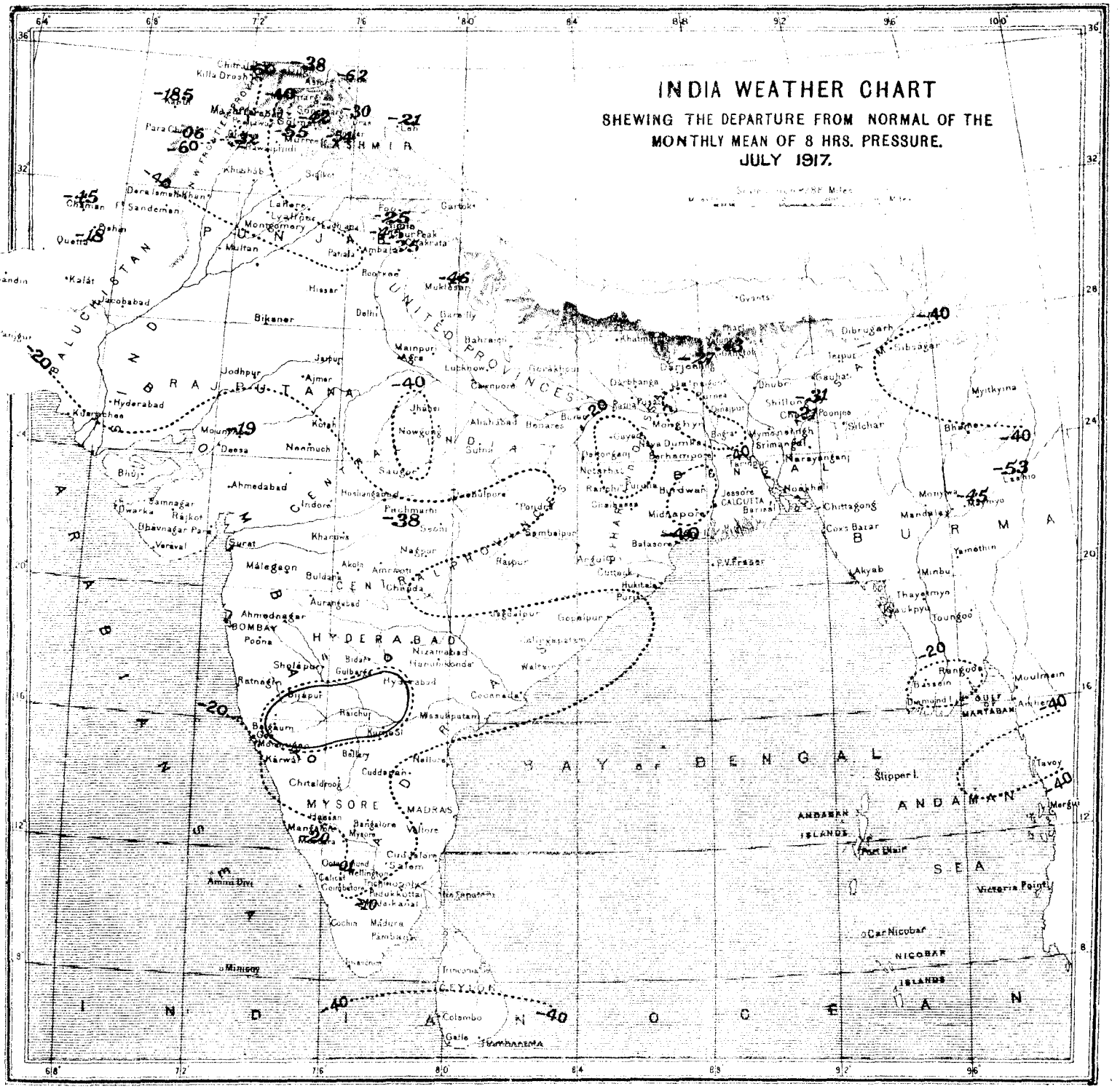


The lines of the above chart represent isobars or lines of equal barometric pressure, the numbers attached indicating the barometric pressure in inches and being drawn for differences of pressure of ·05 inch. The isobars in the Bay of Bengal are filled in by means of the shore observations, and by comparison with the normal distribution of pressure.

The mean 8 hrs. wind directions of the month are shewn by means of arrows flying with the wind, and are calculated by means of Lambert's formula applied to the winds as given in Table B of the 8 hrs. observations. The mean wind directions for the hill stations are indicated by broken arrows to distinguish them from the wind arrows for the plain stations. The mean velocity of the winds during the month is shewn by the following notation:—

Velocity of	0 to 2 miles per hour	...	one feather added to the wind arrow.
,, ,,	2 to 5 ,, ,, ,,	...	two feathers ,, ,, ,, ,,
,, ,,	5 to 10 ,, ,, ,,	...	three ,, ,, ,, ,, ,,
,, ,,	10 to 20 ,, ,, ,,	...	four ,, ,, ,, ,, ,,
	over 20 ,, ,, ,,	...	five ,, ,, ,, ,, ,,

Wind strengths are based on factor 2·2 for the standard type of Beckley Robinson anemograph, instead of 3·0 as used for this plate up to December 1911 inclusive.



The chart shows the departure from normal of the mean during the month of 8 hrs. pressure by means of lines drawn for equal amounts of departure. The numbers are given in thousandths of an inch, 20 representing ·020″ or two hundredths of an inch, &c. Continuous lines indicate that the pressure was in excess by amounts indicated by the numbers attached to the lines, and broken or dotted lines that it was in defect by amounts indicated by the numbers attached to the lines. Two parallel lines near to each other, one continuous and the other broken or dotted, represent the line of no departure, the dotted line facing the area of deficient pressure or negative departures.

CHART SHEWING THE DEPARTURE FROM NORMAL
OF THE MONTHLY MEAN OF DAILY
MAXIMUM TEMPERATURE.

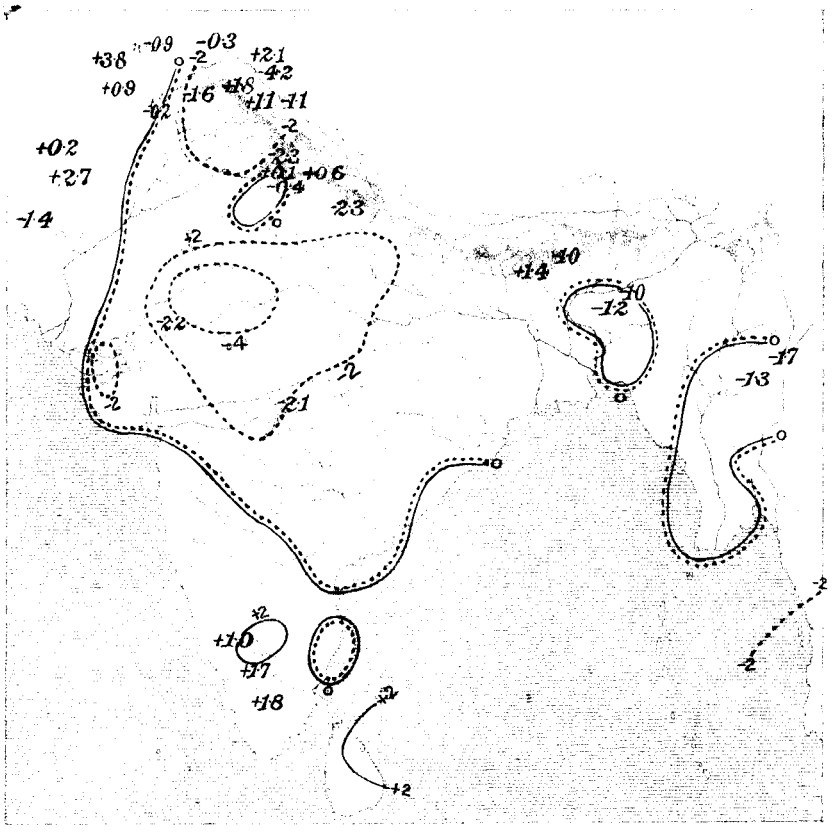


CHART SHEWING THE DEPARTURE FROM NORMAL
OF THE MONTHLY MEAN OF DAILY
MINIMUM TEMPERATURE.

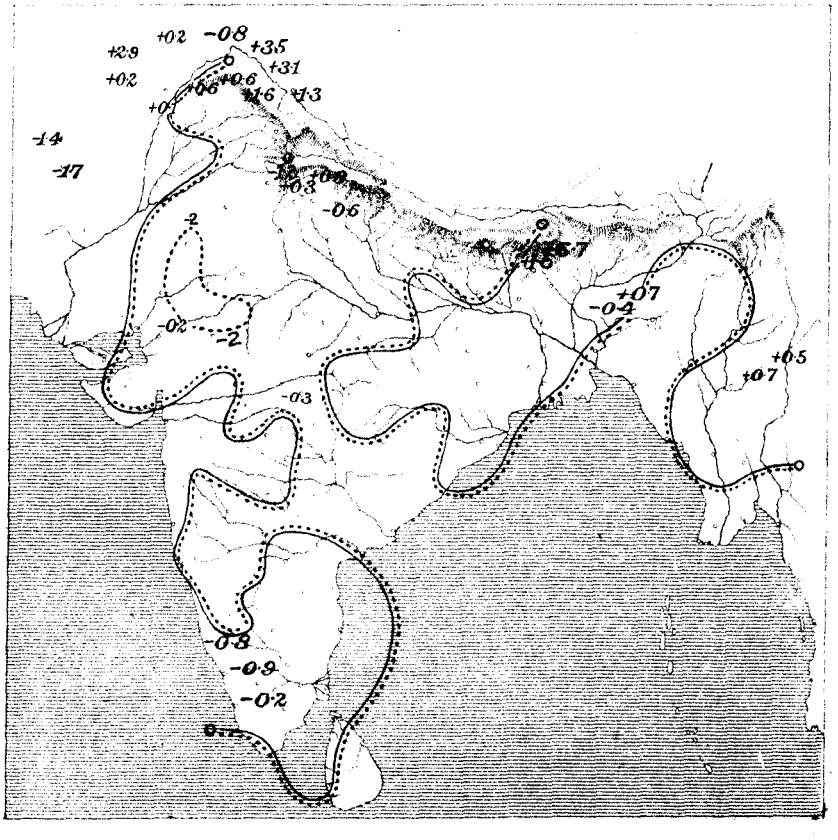


CHART SHEWING THE DEPARTURE FROM NORMAL
OF THE MONTHLY MEAN OF DAILY
MEAN TEMPERATURE.

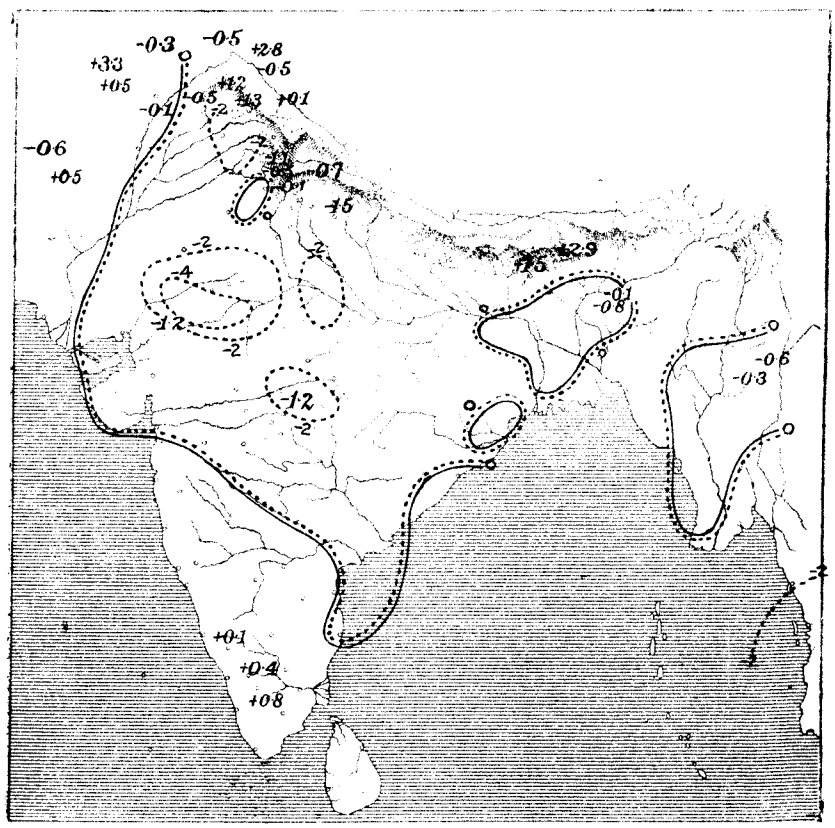


CHART SHEWING THE DEPARTURE FROM NORMAL
OF THE MONTHLY MEAN OF ABSOLUTE
HUMIDITY AT 8 HRS.

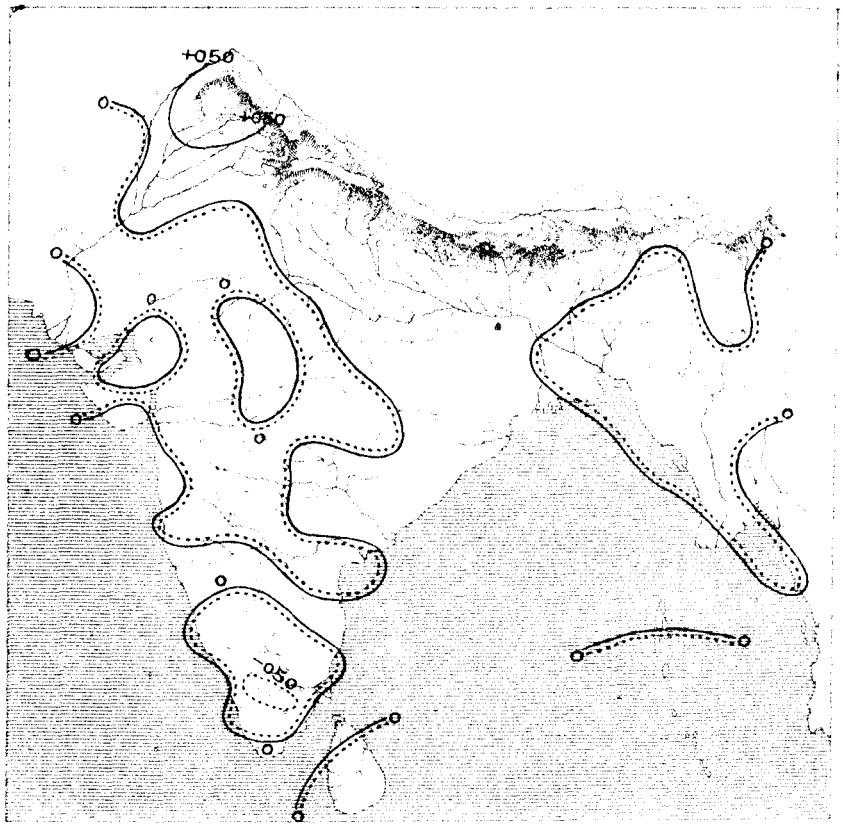


CHART SHEWING THE DEPARTURE FROM NORMAL
OF THE MONTHLY MEAN OF RELATIVE
HUMIDITY AT 8 HRS.

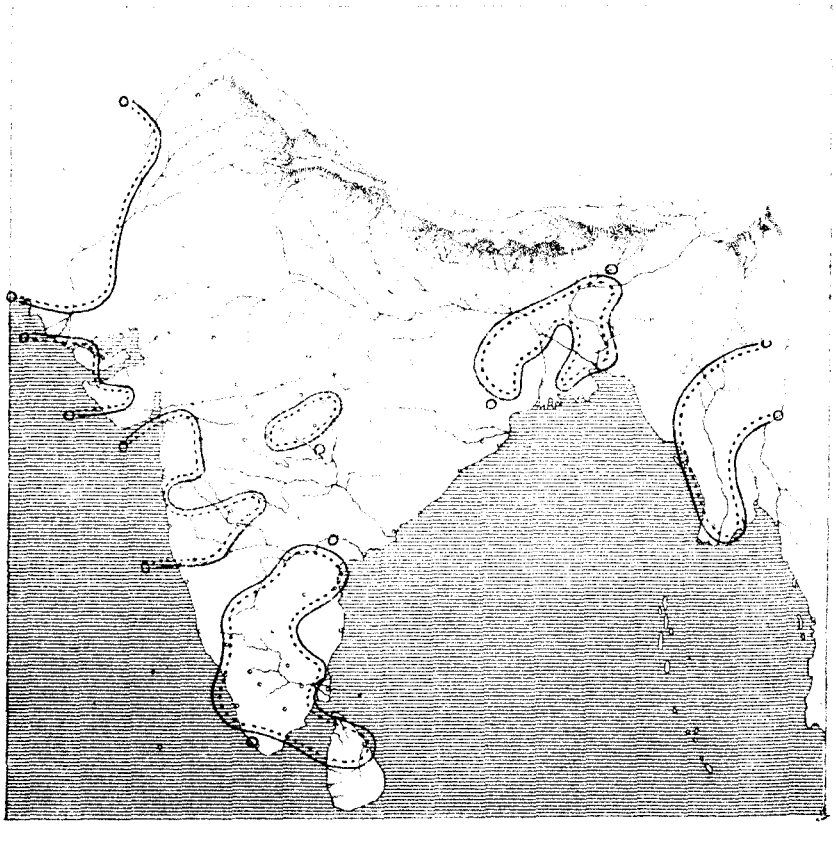


CHART SHEWING THE DEPARTURE FROM NORMAL
OF THE MONTHLY MEAN OF CLOUD
AMOUNT AT 8 HRS.

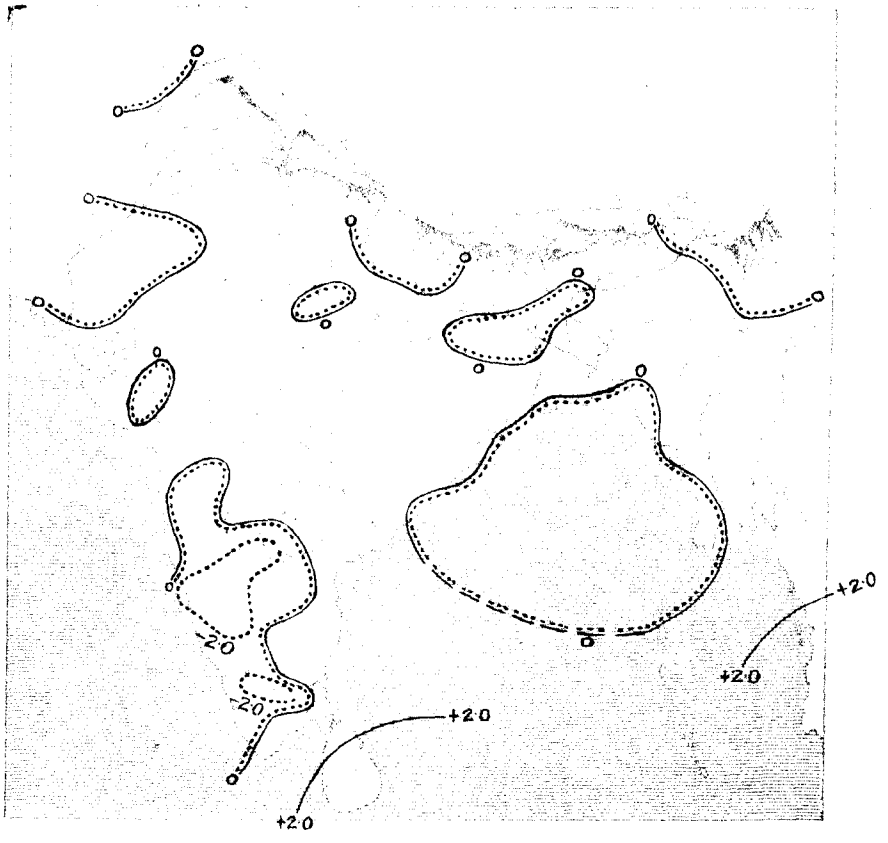
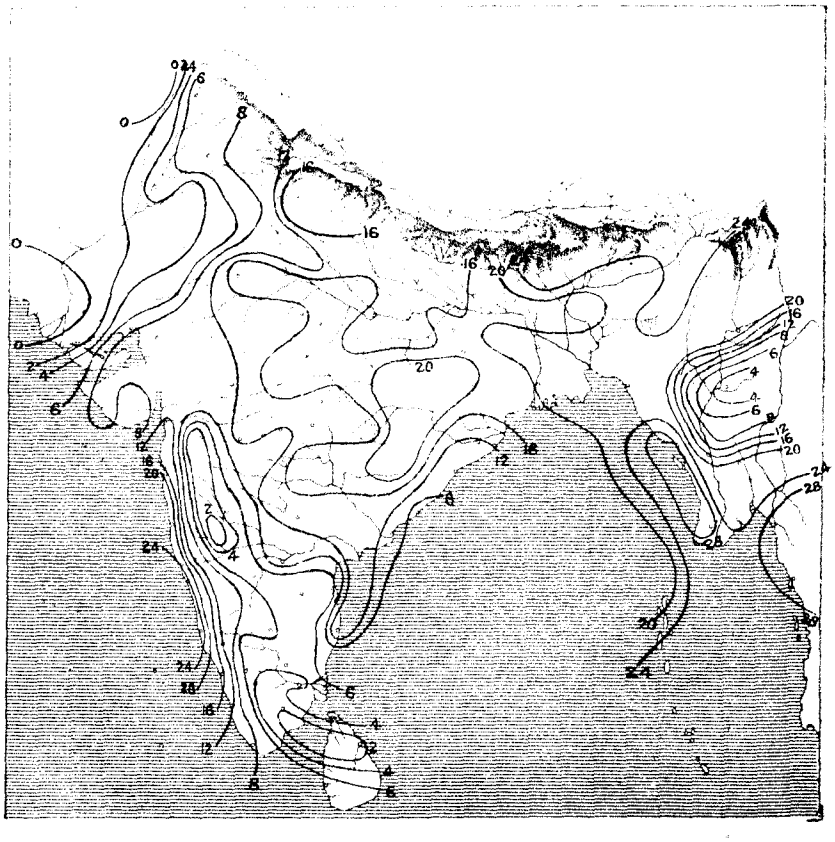
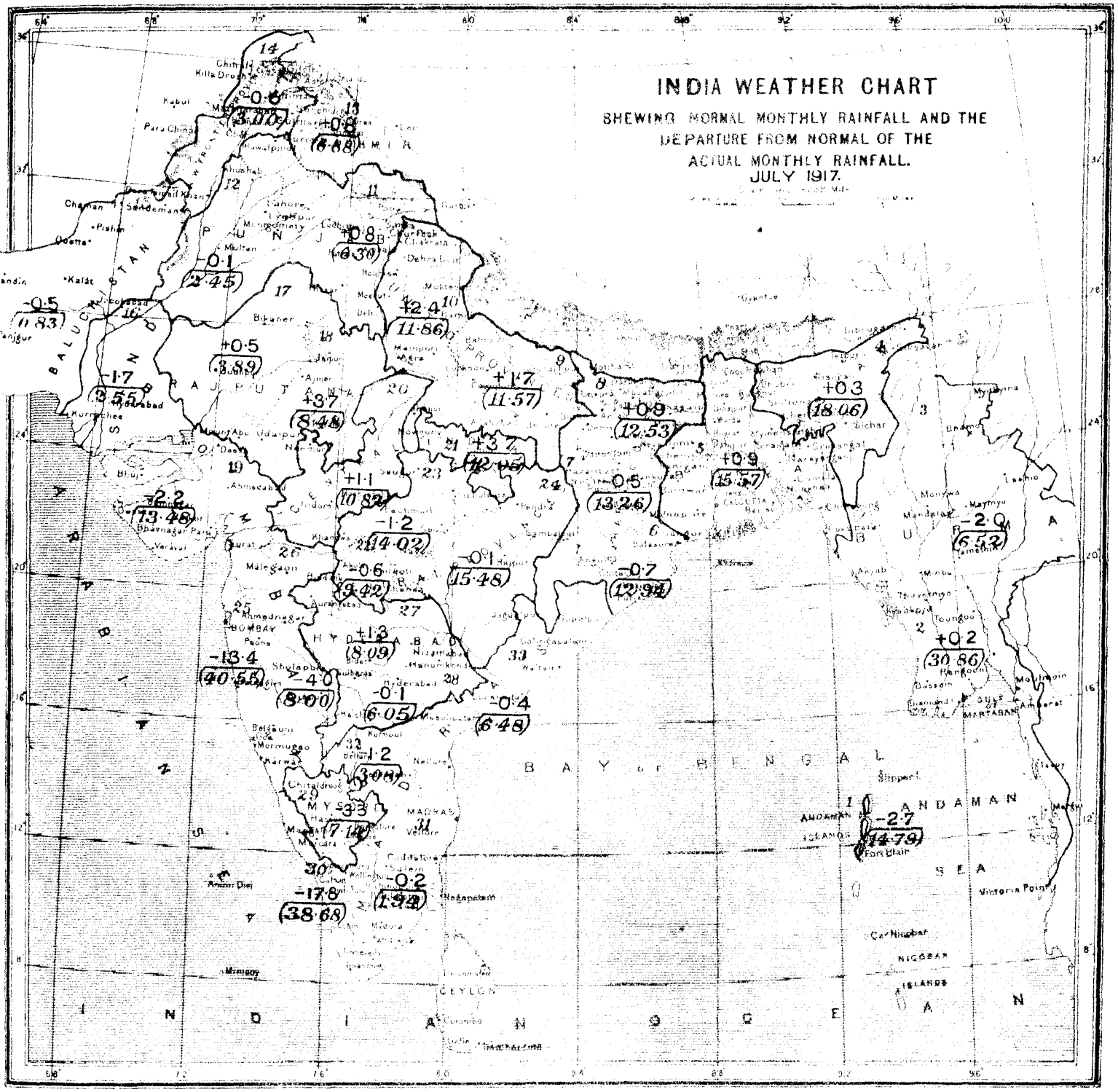


CHART SHEWING THE TOTAL NUMBER OF DAYS IN THE
MONTH ON WHICH RAINFALL EQUALLED OR
EXCEEDED 0·10 INCH.
(BASED ON THE RETURNS OF TABLE B.)





The country is divided into 33 areas as shewn in the list below. The numbers in that list correspond with the red numbers on the chart, and serve to identify the areas. The numbers in brackets on the chart give the average over the divisions of the normal monthly rainfall, the numbers above these give the departures from normal of the average actual rainfall over the divisions.

1. Bay Islands
2. Lower Burma
3. Upper Burma
4. Assam
5. Bengal
6. Orissa
7. Chota Nagpur
8. Bihar
9. United Provinces, East
10. United Provinces, West
11. Punjab, East and North
12. Do., Southwest
13. Kashmir
14. Northwest Frontier Province
15. Baluchistan
16. Sind
17. Rajputana, West
18. Rajputana, East
19. Gujarat
20. Central India, West
21. Do., East
22. Berar
23. Central Provinces, West
24. Do., East
25. Konkan
26. Bombay, Deccan
27. Hyderabad, North
28. Hyderabad, South
29. Mysore
30. Malabar
31. Madras, Southeast
32. Madras, Deccan
33. Madras Coast, North

GOVERNMENT OF INDIA.

METEOROLOGICAL DEPARTMENT.

MONTHLY WEATHER REVIEW

PUBLISHED BY ORDER OF

THE GOVERNMENT OF INDIA.

CALCUTTA, AUGUST, 1917.

INTRODUCTION.

THIS review of the weather in India during the month of August, 1917, is based on observations taken daily at 8 hrs. at 218 stations, and on additional observations taken at 10 hrs. and 16 hrs. at 11 stations. In the rainfall summary have been utilized the data furnished by the meteorological observatories, and the rainfall statements of the month published by the Provincial Governments.

The brief notes on solar, magnetic and seismic disturbances are supplied by the chief observatories in the Indian area.

For a statement of the methods adopted in recording and tabulating the data, for each of the elements of observation, reference should be made to the introductory portion of the review for January.

Summary of the chief features of the weather in India during the month.

2. The Arabian Sea current was much more active than usual, particularly in northwest India, where in conjunction with disturbances from western regions it was productive of abnormally heavy rain. The Bay current on the other hand was appreciably weaker than usual. The month was unusually wet over a large part of the country. Indeed Lower Burma, Assam, Bengal, Bihar, the United Provinces, Berar and Malabar were the only areas which received appreciably less than the normal quantity of rainfall. Rainfall was very heavy for the time of year in northwest India, but more especially in the Punjab Southwest and Baluchistan, where it was upwards of three times the normal amount. Upper Burma, Chota Nagpur, Central India, the Central Provinces West, the Konkan, Hyderabad, Mysore, Madras Southeast, the Madras Deccan and the Madras Coast North also recorded much heavier amounts than usual. On the other hand in Bihar there was a large defect, amounting to about 29 per cent. There was opportune rain in the Bombay Deccan.

As is ordinarily the case during the rains, the departures of temperature, humidity and cloud over a large part of the country were determined by those of rainfall; compared with the normal, humidity and cloud were distinctly high over most of northwest India, while temperature was about 3° lower than usual in the Punjab, the North-West Frontier Province and Rajputana.

Barometric pressure averaged over the plains of India was in excess by ·010″.

Solar, magnetic and seismic disturbances.

KODAIKANAL OBSERVATORY.

3. *Solar Observations.*—The sun was examined for spots and faculæ on all the days of the month except on the 14th. Prominences could not be recorded on the 14th and 16th.

Sunspots.—Forty-five new groups of spots were observed as against thirty in July. The daily average number was 8·8 and the average life of a spot was 5·8 days, the averages for the preceding month being 6·7 and 6·8 respectively. The distribution of the spots in latitude was as follows :—

TABLE 1.

—	0°—10°	11°—20°	21°—30°	Mean latitude.	Extreme latitudes.
North . . .	8	9	3	13°·1	1° and 29°
South . . .	1	15	9	17°·4	8° and 27°

A group of scattered spots which came round the east limb on the 4th developed into a very large spot of multiple umbra as it approached the central meridian and was visible to the unaided eye. Strong reversals and displacements of the C line over and close to the spot were observed on several days.

Prominences.—Eighty-one large prominences were observed during the month. The highest was 180″ and was observed on the 1st at latitude + 20° east. No eruptive or metallic prominence was recorded.

Absorption markings in Hα photographs of the sun were numerous and also of great extent.

Magnetic disturbances.—One "very great" disturbance was recorded on the 9th when the large spot was about a day's journey from the central meridian. "Great" disturbances were also recorded on the 13th to 15th, 20th to 21st, and 25th. "Moderate" disturbances were recorded on the 1st, 7th to 8th, 10th to 12th, 16th, 22nd to 23rd, 26th and 30th.

J. EVERSHED,
Director,
Kodaikanal and Madras Observatories.

Seismic records.

$\phi = 10° 13' 50''$ N ; $\lambda = 77° 28' 00''$ E ; $h = 2{,}343$ m. Subsoil Rock.

Apparatus.—Milne's Horizontal Pendulum Seismograph.

TABLE 2.

	V	To	C	$\frac{r}{To^2}$
AN:				
AE:	9·76	18·0	1	2·7
AZ:				

Date.	Phase.	Time G. M. T.	Period (Sec.).	Amplitude (u). An.	Ae.	Az.	Distance Δ (Km.).	Remarks.
1917.		h. m. s.						
August 3rd	e P	21 49 24	...	...	...	...	...	
	i L	21 53 30	...	...	...	...	...	
	M	21 54 30	...	...	80	...	...	
	F	22 05 12	...	...	...	...	...	
„ 5th	e P	16 36 36	...	...	...	...	...	
	e L	16 47 06	...	...	...	...	...	
	M	16 54 48	...	...	130	...	...	
	F	18 06 48	...	...	...	...	...	
August 30th	P	...	...	...	...	...	...	No P.'s.
	i L	4 16 30	...	...	...	...	...	
	M	4 42 18	..	...	420	...	...	
	F	6 32 30	...	...	...	...	...	
„ 31st	e P	11 56 42	...	...	...	...	...	
	e L	13 01 48	...	...	...	...	...	
	M	13 05 24	...	...	170	...	...	
	F	14 05 54	...	...	...	...	...	

T. ROYDS,
Assistant Director.

BOMBAY OBSERVATORY.

Alibag magnetic record.

4. During the month of August, 1917, the traces showed 11 calm days, 15 days of small and 4 days of moderate and 1 day of great disturbance.

The days of the month selected as "quiet" for the purposes of the Magnetic Survey of India are the 3rd, 6th, 12th, 28th and 29th.

The following table represents the magnetic character of each day during the month :—

TABLE 3.

Day.	Character.	Day.	Character.	Day.	Character.	Day.	Character.
1	S	9	G	17	S	25	C
2	S	10	M	18	C	26	S
3	C	11	S	19	C	27	S
4	C	12	C	20	S	28	C
5	C	13	M	21	M	29	C
6	C	14	M	22	S	30	S
7	S	15	S	23	S	31	C
8	S	16	S	24	S	...	...

C=calm ; S=small ; M=moderate ; G=great ; V. G.=very great.

The mean observed absolute values of the several magnetic elements reduced to the mean monthly tabulations of the magnetograms, as also the ranges and the summed ranges of the horizontal force and the declination for the month are as follows :—

Easterly declination	0° 32′ 13″.
Horizontal force	0·36853 C.G.S. unit.
Vertical force	0·16893 C.G.S. „
Inclination	24° 37′·6.
Horizontal force range . . .	0·00055 C.G.S. unit.
„ „ summed range . .	0·00365 C.G.S. „
Declination range	6′·1.
„ summed range . .	25′·1.

(NOTE.—Summed range means sum without regard to sign of the twenty-four ordinates of the diurnal inequality.)

Seismic records.

$\Phi = 18° 53′ 36″$ N ; $\lambda = 72° 48′ 56″$ E ; $h = 11$ m. Subsoil Trap.

Apparatus.—Milne's Horizontal Pendulum Seismograph.

TABLE 4.

	V	To	ϵ	$\frac{r}{To^2}$
AN :				
AE :	9	19		
AZ :				

Date.	Phase.	Time G. M. T.	Period (Sec.).	Amplitude (u). An.	Ae.	Az.	Distance △ (Km.).	Remarks.
1917.		h. m. s.						
August 5th	P	16 29 14	...	...	..	...	...	
	M	17 1 38	...	...	78	...	...	
	F	18 16 20	...	...	...	...	...	
„ 12th	...	m m 11 52 to 58	...	...	...	...	...	Thickening of line.
„ 15th	...	4 37 to 44	...	...	...	...	...	Ditto.
„ 23rd	...	16 36 0	...	...	...	...	...	Ditto.
„ 25th	...	21 51 to 56	...	...	...	...	...	Ditto.
„ 26th	...	20 17 to 27	...	...	...	...	...	Ditto.
„ 27th	...	16 55 0	...	...	...	...		Ditto.

Date.	Phase.	Time G. M. T.	Period (Sec.).	Amplitude (u). An.	Ae.	Az.	Distance △ (Km.).	Remarks.
1917.		h. m. s.						
August 30th	P	*4 17 19	...	...	...	...	...	In Milne's instrument disturbance lost in faulty record.
	S	*4 25 24	...	...	...	...	...	
„ 31st	P	11 59 26	...	...	.	...	...	
	M	13 6 13	...	...	167	...	...	
	F	13 54 37	...	..	...	...	...	

Sensibility to tilt 1·0 mm. of amplitude on the trace = 0·32″.

* These times are as shown by the float record (Tilt Seismograph).

N. A. F. MOOS,
Director,
Bombay and Alibag Observatories.

5.—CALCUTTA (ALIPORE) OBSERVATORY.

Seismic records.

$\phi = 22° 32′$ N ; $\lambda = 88° 20′$ E ; $h = 6·4$ m. Subsoil Alluvial.

Apparatus.—Two Omori-Ewing Horizontal Pendulum Seismographs.

TABLE 5.

	V	To	ϵ	$\frac{r}{To^2}$
AN :	29	18	1	
AE :	29	42	1	
AZ :				

Date.	Phase.	Time G. M. T.	Period (Sec.).	Amplitude (u). An.	Ae.	Az.	Distance △ (Km.).	Remarks.
1917.		h. m. s.						
Aug. 30th	P	4 15 54	?	...	...	...	...	
	S	4 22 48	15	...	...	...	...	
	L	4 28 42	?	...	...	...	...	
	M	4 32 0	...	827	...	...	...	
	F	5 4 30	...	...	...	...	...	

D. B. MEEK.

6.—SIMLA OBSERVATORY.

The Seismographs at the Simla Meteorological Office had been dismantled in July 1917 and were set up again in a new building in October 1917.

The following table contains a list of earthquakes that were reported :—

TABLE 6.

Place at which felt.	Date.	G. M. T. of earthquake.	Duration.	Intensity Rossi-Forel scale.	No. of shocks.	REMARKS.
		h. m.	sec.			
Drosh . . .	Aug. 4th	8 45	5	7	2	
Sibsagar . .	„ 9th	4 10	...	...	1	
Shillong . .	Aug. 14th	14 47	2	5	1	
Srinagar . .	„ 22nd	1 12	5	5	1	

Solar radiation.—Observations not recorded owing to the absence of officers on war service.

C. W. B. NORMAND,
Imperial Meteorologist, Simla.

Weather in the Indian Ocean.

7. Barometric pressure was in defect by '02" at the equatorial stations as well as at Mauritius. Rainfall was above the average at all the three stations, the excess being as much as 65 per cent. at Seychelles. The air movement was somewhat weaker than usual at Zanzibar, but stronger at Seychelles and Mauritius, its direction was considerably more westerly at Zanzibar but somewhat more southerly at the other stations.

TABLE 7.

	Mauritius.*	Zanzibar.	Seychelles.
Departure from normal of mean pressure	—·019	—·021	—·017
Actual mean wind direction . .	S 54° E	S 24° W	S 20° E
Normal mean wind direction . .	S 68° E	S 1° W	S 35° E
Actual mean wind velocity (miles per diem).	288	108	263
Normal mean wind velocity (miles per diem).	271	120	231
Rainfall departure from normal . .	+0·41	+0·33	+1·67

*Based on weekly telegrams.

Depressions and cyclonic storms.

8. During the month three disturbances were transmitted into the extreme north of India from the west. The first of these in conjunction with the monsoon gave widespread rain in the North-West Frontier Province, Kashmir and the north Punjab between the 5th and 10th. The second caused local rain in Kashmir on the 18th. The third disturbance was feeble and gave only light rain in the extreme north on the 29th and 30th.

There were four depressions of Indian origin ; three of them were formed over the Bay, while the fourth appeared over the east of Central India. The following is a brief statement of these four depressions :—

(*a*) *Depression of the 30th July to 3rd August* :—This originated over the head of the Bay and the adjacent parts of Bengal during the 29th July, moved to Bihar and Chota Nagpur by the morning of the 1st August and, advancing slowly in a northwesterly direction, disappeared over the northwest of the United Provinces during the 4th. It was feeble, but was remarkable for the excessive rain in the neighbourhood of Hazaribagh, which caused destructive floods in the Gaya and Patna districts. The following heavy falls of rain are particularly worthy of record :—

TABLE 8.

Province.	District.	Station.	AMOUNT RECEIVED IN 24 HOURS PRECEDING 8 HRS. OF		TOTAL.
			1st.	2nd.	
			"	"	"
Bihar .	Gaya .	Aurangabad .	7·50	4·50	12·00
		Sherghati .	11·74	12·14	23·88
		Deo . .	12·22	12·50	24·72
		Barachati .	9·50	6·11	15·61
Chota Nagpur.	Hazaribagh .	Hazaribagh .	5·62	6·87	12·49
		Barhi .	10·51	3·55	14·06
		Chatra .	8·63	14·58	23·21
		Koderma .	12·80	1·50	14·30
		Hunterganj .	18·40	0·86	19·26

Province.	District.	Station.	Amount received in 24 hrs. preceding 8 hrs. of 1st.	Amount received in 24 hrs. preceding 8 hrs. of 2nd.	Total.
			"	"	"
Chota Nagpur—*concld.*	Palamau	Balumath	4·75	8·65	13·40
		Panki	3·25	12·69	15·94
		Chattarpur	4·00	8·11	12·11
		Bhaonathpur	2·00	9·00	11·00
		Patan	2·60	9·65	12·25
		Manatu	3·83	7·75	11·58
		Lesliganj	4·10	7·05	11·15

(*b*) *Depression of the 6th to the 12th.*—This appeared off the Orissa coast during the 6th, but had moved into Chota Nagpur and the east of the Central Provinces by the morning of the 8th: it was central near Nowgong on the morning of the 9th, and between Jodhpur and Bikaner on the morning of the 10th. It was shown over Sind and the southwest of the Punjab on the morning of the 11th and disappeared over Baluchistan during the 12th. It was shallow and gave heavy rain only in parts of Rajputana.

(*c*) *Land formed depression of the 11th to the 14th.*—This was developed over the east of Central India during the 11th and after remaining practically stationary for a day, during which time it intensified slightly, began to move in a westnorthwesterly direction during the 13th; it was between Jhansi and Nowgong on the morning of the 14th and had become unimportant by the morning of the 15th. It was very feebly marked and did not produce any concentration of rainfall.

(*d*) *Depression of the 23rd to the 26th.*—This was formed off the Orissa coast during the 23rd and by the morning of the 25th had moved into the east of the Central Provinces; it was over the east of Central India on the morning of the 26th and by the morning of the 27th had disappeared. Throughout its existence it was very feeble and did not give any notably heavy falls.

Pressure.

9. On the mean of all the recording stations in the plains the barometric pressure for the month was ·010″ higher than usual. The excess was however not general; the recorded monthly values were nearly normal in Rajputana, Central India, the Central Provinces and Hyderabad, and in defect in the Bombay Presidency, excluding Sind, Malabar, Mysore and southeast Madras. The deficiency was ·020″ or more along the coast from Veraval to Nellore. The positive departures were more strongly marked over northern India excluding Rajputana and the southwest of the United Provinces, and averaged ·046″ in the North-West Frontier Province and varied between ·030″ and ·040″ in Bengal, Bihar and Orissa and the Punjab. As a result of these peculiarities in the distribution of pressure, gradients were less steep than usual in the Peninsula and the area of low pressure lay further south than usual, while the eastern extremity of the monsoon trough did not extend into the head of the Bay as in normal years. This abnormal position of the trough was instrumental in determining excessive rainfall to the comparatively dry zone of northwest India.

Relative to the plains pressure at the level of the hill stations was in defect, or in other words the vertical gradient was above its normal strength, except in the south of the Peninsula where pressure was relatively higher at the hill stations.

TABLE 9.

Division.	Departure from normal of mean 8 hrs. pressure.
	"
Burma	+·010
Assam	+·027
Bengal	+·039
Bihar and Orissa	+·030
United Provinces	+·024
Punjab	+·040
North-West Frontier Province	+·046
Sind	+·021
Rajputana	0
Bombay	—·014
Central India	—·003
Central Provinces	0
Hyderabad	—·001
Mysore	—·013
Madras	—·016

TABLE 10.

Hill station.	Departure from normal pressure. A.	Plain station.	Departure from normal pressure. B.	Departure of pressure difference B—A.
	"		"	"
Quetta	+·005	Jacobabad	+·038	+·033
Leh	+·040	Lahore	+·044	+·004
Murree	+·010	Peshawar	+·033	+·023
Simla	+·025	Ludhiana	+·048	+·023
Darjiling	+·034	Dhubri	+·041	+·007
Mount Abu	—·014	Deesa	—·006	+·008
Pachmarhi	—·035	Khandwa	—·009	+·026
Kodaikanal	—·012	Madura	—·025	—·013

Temperature.

10. Maximum temperature was approximately normal except in the plains of northwest India, where in keeping with the excess of rainfall and cloud proportion it was appreciably lower than usual. The deficiency averaged 7½° in the Punjab Southwest, 5° in the North-West Frontier Province, 4½° in Rajputana and about 3° in the Punjab East and North and in Sind. Minimum temperature was also nearly 2½° below the average in the Punjab Southwest and Rajputana West; in Kashmir and Baluchistan on the other hand, it was in excess by 2½° and 4° respectively.

TABLE 11.

SUB-DIVISION.	ACTUAL TEMPERATURE.				DEPARTURE FROM NORMAL OF		
	Mean maximum.	Mean minimum.	Monthly mean of mean between maximum and minimum.	Mean daily range of temperature.	Maximum.	Minimum.	Daily range.
	°	°	°	°	°	°	°
1. Bay Islands	84·3	77·2	80·7	7·1	—0·5	0	—0·5
2. Lower Burma	84·9	75·3	80·1	9·7	+0·6	+0·4	+0·2
3. Upper Burma	88·5	75·5	82·0	13·0	—0·7	0	—0·7
4. Assam	89·6	77·3	83·5	12·3	+1·1	+0·1	+1·0
5. Bengal	87·6	77·9	82·8	9·7	0	0	0
6. Orissa	87·8	78·1	83·0	9·7	—0·1	+0·1	—0·2
7. Chota Nagpur	87·3	75·6	81·4	11·7	—0·4	—0·2	—0·2
8. Bihar	89·6	78·7	84·1	10·9	+0·2	0	+0·2
9. United Provinces, East	90·4	78·9	84·6	11·5	+0·6	+0·3	+0·3
10. Do. do., West	90·0	78·1	84·0	11·9	—0·3	0	—0·3
11. Punjab, East and North	91·5	77·7	84·6	13·8	—2·7	—0·7	—2·0
12. Do., South-west	93·6	79·4	86·5	14·2	—7·5	—2·5	—5·0
13. Kashmir	81·6	61·8	71·7	19·8	—1·5	+2·4	—3·9
14. North-West Frontier Province	95·0	79·1	87·1	15·9	—5·1	—0·5	—4·6
15. Baluchistan	97·1	71·4	84·3	25·7	+0·7	+3·9	—3·2
16. Sind	92·1	79·7	85·9	12·4	—3·2	+0·2	—3·4
17. Rajputana, West	91·3	77·3	84·3	14·1	—4·1	—2·3	—1·8
18. Do., East	85·3	76·2	80·7	9·1	—4·7	—0·9	—3·8
19. Gujarat	86·3	76·5	81·4	9·8	—1·4	—0·1	—1·3
20. Central India, West	83·0	72·9	78·0	10·1	—0·7	+0·9	—1·6
21. Do. do., East	85·9	76·6	81·3	9·3	—1·1		—1·1
22. Berar	86·7	72·9	79·8	13·8	+1·6	+1·1	+0·5
23. Central Provinces, West	84·3	73·1	78·7	11·2	—0·3	0	—0·3
24. Do. do., East	85·3	73·5	79·4	11·9	+0·1	+0·2	—0·1
25. Konkan	83·0	75·8	79·4	7·2	—0·4	+0·1	—0·5
26. Bombay Deccan	85·2	70·2	77·7	15·0	+0·5	+0·6	—0·1
27. Hyderabad, North	85·4	70·7	78·1	14·7	+0·4	+0·9	—0·5
28. Do., South	88·1	73·5	80·8	14·6	+0·5	+0·7	—0·2
29. Mysore	82·2	67·2	74·7	15·1	+0·8	+0·9	—0·1
30. Malabar	82·9	74·4	78·7	8·6	—0·1	0	—0·1
31. Madras, South-east	91·8	76·1	84·0	15·7	—1·3	+0·3	—1·6
32. Do. Deccan	91·9	75·7	83·8	16·2	+0·2	+0·8	—0·6
33. Do. Coast, North	90·3	78·3	84·3	12·0	—0·4	—0·1	—0·3

TABLE 12.

Division.	Departure from normal of		
	Mean maximum temperature.	Mean minimum temperature.	Mean temperature.
	°	°	°
Burma	0	+0·2	+0·1
Assam	+1·1	+0·1	+0·6
Bengal	0	0	0
Bihar and Orissa	—0·1	0	0
United Provinces	+0·2	+0·2	+0·2
Punjab	—4·0	—1·2	—2·6
North-West Frontier Province	—5·1	—0·5	—2·7
Sind	—3·2	+0·2	—1·5
Rajputana	—4·5	—1·4	—3·0
Bombay	—0·7	+0·1	—0·2
Central India	—0·9	+0·5	—0·2
Central Provinces	+0·3	+0·3	+0·3
Hyderabad	+0·5	+0·8	+0·6
Mysore	+0·8	+0·9	+0·8
Madras	—0·7	+0·2	—0·2

Winds.

11. (*a*) The air movement did not depart appreciably from the normal in Burma, Assam, Bihar and Orissa, the United Provinces, the Punjab, the Central Provinces, Mysore and Madras, but was weaker than usual elsewhere; the deficiency exceeded 20 per cent. in Bengal, the North-West Frontier Province, Sind and Rajputana.

(*b*) The degree of steadiness was very high in the United Provinces and low in the North-West Frontier Province, Sind, Rajputana and Central India: the unsteadiness in the first of these areas was apparently due to the frequent changes in the position of the seat of minimum pressure in northwest India, and in Central India to the extension southwards of the central portion of the trough.

(*c*) The direction of wind differed to no great extent from the normal over a large part of the country, but in northeast Baluchistan and in the tract from Allahabad to Montgomery there was a markedly easterly component.

TABLE 13.

Division.	Departure from normal of	
	Hourly wind velocity.	Wind steadiness.
Burma	0	— 3
Assam	—0·2	+ 4
Bengal	—0·9	— 7
Bihar and Orissa	+0·1	— 1
United Provinces	—0·1	+24
Punjab	0	+ 3
North-West Frontier Province	—1·1	—29
Sind	—3·4	—16
Rajputana	—1·3	—35
Bombay	—1·6	— 7
Central India	—0·8	—20
Central Provinces	—0·3	— 1
Hyderabad	—1·4	— 3
Mysore	+0·5	+ 4
Madras	—0·4	— 3

Humidity and cloud.

12. Humidity both absolute and relative, was high over by far the greater part of north-west India—the region of marked excess of rainfall; elsewhere it was sensibly normal.

The distribution of cloud corresponded closely with that of humidity and there was considerably more cloud in the North-West Frontier Province, the western and central Punjab, Rajputana, Sind and Gujarat. Elsewhere the cloud proportion did not differ to any marked extent from the average.

TABLE 14.

DIVISION.	HYGROMETRY; 8 HRS.				CLOUD.	
	Mean humidity.	Departure from normal.	Mean vapour tension in inches of mercury.	Departure from normal in inches of mercury.	Mean cloud amount at 8 hrs.	Departure from normal.
	%					
Burma . .	91	+ 1	·886	+·002	8·1	0
Assam . . .	89	− 2	·931	—·009	7·4	—0·4
Bengal . .	89	— 1	·947	—·014	7·2	—0·2
Bihar and Orissa .	87	0	·934	+·007	7·4	+0·2
United Provinces .	86	0	·950	+·018	6·3	—0·3
Punjab . .	85	+ 9	·946	+·063	5·7	+1·7
North-West Frontier Province.	81	+ 9	·937	+·058	5·2	+2·5
Sind . . .	83	+ 7	·923	+·070	5·7	+1·0
Rajputana . .	86	+10	·869	+·054	7·8	+1·6
Bombay . .	87	+ 2	·829	+·012	8·3	+0·6
Central India .	90	+ 3	·839	+·013	9·0	+0·8
Central Provinces .	87	0	·797	+·010	8·4	+0·7
Hyderabad . .	83	+ 2	·744	+·017	7·8	+0·5
Mysore . .	84	0	·635	—·003	7·8	—0·8
Madras . .	80	+ 2	·826	+·017	6·7	0

Rainfall.

13. Rainfall was almost continuous in northern India, but in the Peninsula, apart from the coast districts, there was a well marked break during the first two weeks.

Three disturbances passed into northern India from the Bay and one was developed over Central India. They were not severe, but had the effect of concentrating rainfall in their neighbourhood. The destructive floods in the Gaya and Patna districts in the beginning of the month were caused by the excessive rain in the neighbourhood of Hazaribagh accompanying a depression from the Bay.

The total rainfall of the month was more than 10 per cent. in defect in Lower Burma (3·2″ or 11 per cent.), Assam (3·1″ or 18 per cent.), Bengal (2·4″ or 17 per cent.), Bihar (3·5″ or 29 per cent.), the United Provinces (1·9″ or 16 per cent.), Berar (0·9″ or 12 per cent.) and Malabar (3·9″ or 19 per cent.); it was within 10 per cent. of the normal in the Bay Islands, Orissa and the Central Provinces East; and it was distinctly above the average over the remainder of the country. The excess amounted to $10\frac{3}{5}$″ or 44 per cent. in the Konkan, $7\frac{3}{4}$″ or 97 per cent. in Rajputana East, $6\frac{1}{2}$″ or 281 per cent. in the Punjab Southwest, $5\frac{1}{4}$″ or 115 per cent. in Rajputana West, $3\frac{3}{4}$″ or 33 per cent. in Central India, 4″ or 118 per cent. in the North-West Frontier Province, $3\frac{3}{4}$″ or 43 per cent. in Gujarat and $3\frac{1}{3}$″ or 51 per cent. in the Punjab East and North; it was also considerable in Upper Burma, Chota Nagpur, Kashmir, Baluchistan, Sind, Central India West, the Central Provinces West, Madras South-east and the Madras Deccan. The aggregate fall in the plains of India was above normal by $1\frac{1}{2}$″ or 16 per cent. The most noteworthy feature of the rainfall of the month was its unusual abundance in the comparatively dry zone of northwest India.

TABLE 15.

SUB-DIVISION.	NUMBER OF RAINY DAYS.		RAINFALL.			
	Actual.	Normal.	Actual.	Normal.	Departure from normal.	Percentage departure from normal.
			″	″	″	
1. Bay Islands	18·5	18·1	13·52	13·83	— 0·31	— 2
2. Lower Burma	24·0	24·0	24·62	27·81	— 3·19	— 11
3. Upper Burma	13·3	10·8	10·23	7·41	+ 2·82	+ 38
4. Assam	16·4	18·0	13·88	16·98	— 3·10	— 18
5. Bengal	15·7	16·6	11·92	14·36	— 2·44	— 17
6. Orissa	16·5	15·7	12·63	12·95	— 0·32	— 2.
7. Chota Nagpur	17·1	16·7	16·45	13·40	+ 3·05	+ 23
8. Bihar	12·2	13·9	8·78	12·28	— 3·50	— 29

Sub-division.	Number of rainy days.		Rainfall.			
	Actual.	Normal.	Actual.	Normal.	Departure from normal.	Percentage departure from normal.
			"	"	"	
9. United Provinces, East	12·3	12·7	9·18	11·38	— 2·20	— 19
10. Do. do., West	12·4	11·8	10·17	11·71	— 1·54	— 13
11. Punjab, East and North	11·2	6·8	9·92	6·56	+ 3·36	+ 51
12. Do., South-west	9·7	2·8	8·83	2·32	+ 6·51	+281
13. Kashmir	11·6	8·5	10·86	8·60	+ 2·26	+ 26
14. North-West Frontier Province	7·6	4·3	7·14	3·28	+ 3·86	+118
15. Baluchistan	5·3	1·1	3·41	0·68	+ 2·73	+401
16. Sind	0·6	2·1	4·42	1·77	+ 2·65	+150
17. Rajputana, West	10·8	5·7	9·71	4·51	+ 5·20	+115
18. Do., East	17·7	9·5	15·56	7·88	+ 7·68	+ 97
19. Gujarat	15·9	11·0	12·07	8·42	+ 3·65	+ 43
20. Central India, West	16·7	12·4	13·19	10·07	+ 3·12	+ 31
21. Do. do., East	16·0	12·8	15·24	12·00	+ 4·24	+ 35
22. Berar	9·9	10·6	6·39	7·27	— 0·88	— 12
23. Central Provinces, West	17·6	14·1	15·18	12·25	+ 2·93	+ 24
24. Do. do., East	17·1	15·5	14·61	14·46	+ 0·15	+ 1
25. Konkan	25·9	24·3	34·63	23·99	+10·64	+ 44
26. Bombay Deccan	11·1	9·7	6·51	5·61	+ 0·90	+ 16
27. Hyderabad, North	13·7	11·1	9·27	7·64	+ 1·63	+ 21
28. Do, South	12·7	10·6	7·69	6·65	+ 1·04	+ 16
29. Mysore	10·0	8·9	6·60	5·40	+ 1·20	+ 22
30. Malabar	20·6	21·3	16·36	20·27	— 3·91	— 19
31. Madras, South-east	8·3	5·6	6·22	3·73	+ 2·49	+ 67
32. Do. Deccan	8·8	6·8	6·05	4·07	+ 1·98	+ 49
33. Do. Coast, North	11·4	10·3	8·16	6·93	+ 1·23	+ 18

TABLE 16.

Division.	Rainfall.			
	Actual.	Normal.	Departure from normal.	Percentage departure from normal.
	"	"	"	
Burma	15·88	15·42	+0·46	+ 3
Assam	13·88	16·98	—3·10	— 18
Bengal	11·92	14·36	—2·44	— 17
Bihar and Orissa	11·62	12·73	—1·11	— 9
United Provinces	9·71	11·56	—1·85	— 16
Punjab	9·65	5·52	+4·13	+ 75
North-West Frontier Province	7·14	3·28	+3·86	+118

Division.	Rainfall.			
	Actual.	Normal.	Departure from normal.	Percentage departure from normal.
	"	"	"	
Sind	4·42	1·77	+2·65	+149
Rajputana	13·53	6·86	+6·67	+ 97
Bombay	13·35	9·81	+3·54	+ 36
Central India	14·70	11·04	+3·66	+ 33
Central Provinces	12·50	11·71	+0·79	+ 7
Hyderabad	8·52	7·17	+1·35	+ 19
Mysore	6·60	5·40	+1·20	+ 22
Madras	7·70	6·23	+1·47	+ 24
Mean of India	11·49	9·94	+1·55	+ 16

Snowfall.

I.—AFGHANISTAN.

14. No report has been received and probably there has been no snowfall.

II.—NORTH-WEST FRONTIER PROVINCE.

Drosh:—During the month snow disappeared from the high ranges round Chitral.

III.—KASHMIR.

There was no snowfall on the ranges near Gulmarg, Skardu, Kargil, Dras and Srinagar. The mountains around Skardu had become bare of snow by the end of the month.

IV.—PUNJAB.

There were no snow storms during the month on the ranges adjacent to Kilba.

V.—UNITED PROVINCES.

Almora:—The total snowfall during the month was 1½ feet in Chaudas and Malla Johar, 5 feet in Malla Darma, 2 feet in Malla Danpur, and 6¾ feet in Byans. The snow line descended below the line of perpetual snows to a distance of 2 miles in Byans, 3 or 4 miles in Malla Danpur, 1¾ miles in Malla Darma and ¼ mile in Malla Johar.

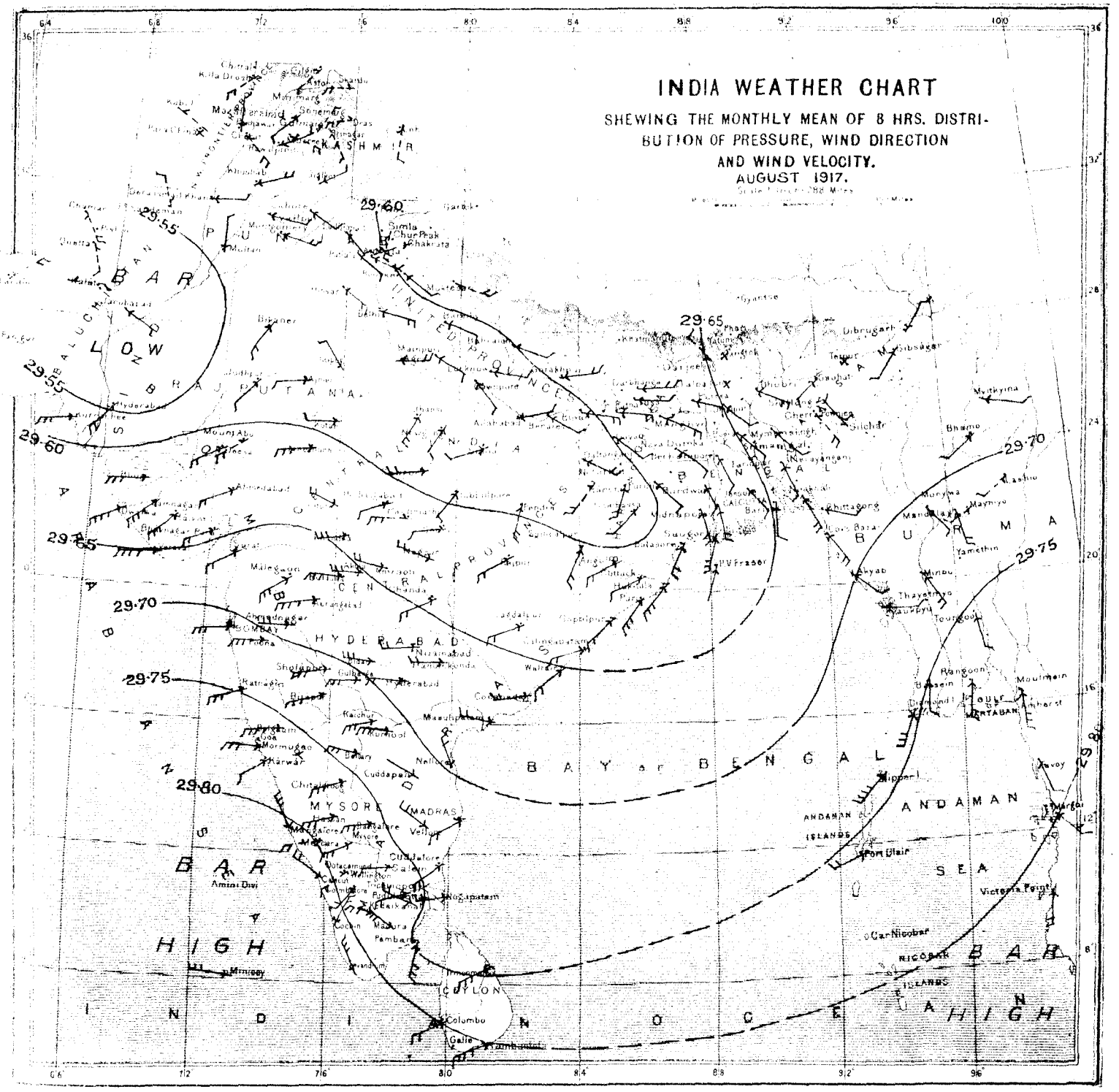
TABLE 17.

Name of pass or peak.	Depth of accumulation at the end of the month.	
	Reported.	Normal.
	Feet.	Feet.
Lampia pass	5½	6½
Lipulekh „	4½	4½
Untadhura peak	1½	5
Pindari „	2	1½
Kaphini „	2	1½
Pualidwar „	2	...
Nuwe pass	12	18
Binkaru „	3	8

SUMMARY.

15. According to the available information there was no snowfall during the month except near the region of perpetual snows in the Kumaon Himalayas. The accumulations at the end of the month in Almora were on the whole less than usual. The high ranges near Kilba where as a rule appreciable accumulations exist in August were clear of snow.

M. G. SUBRAHMANYAM.

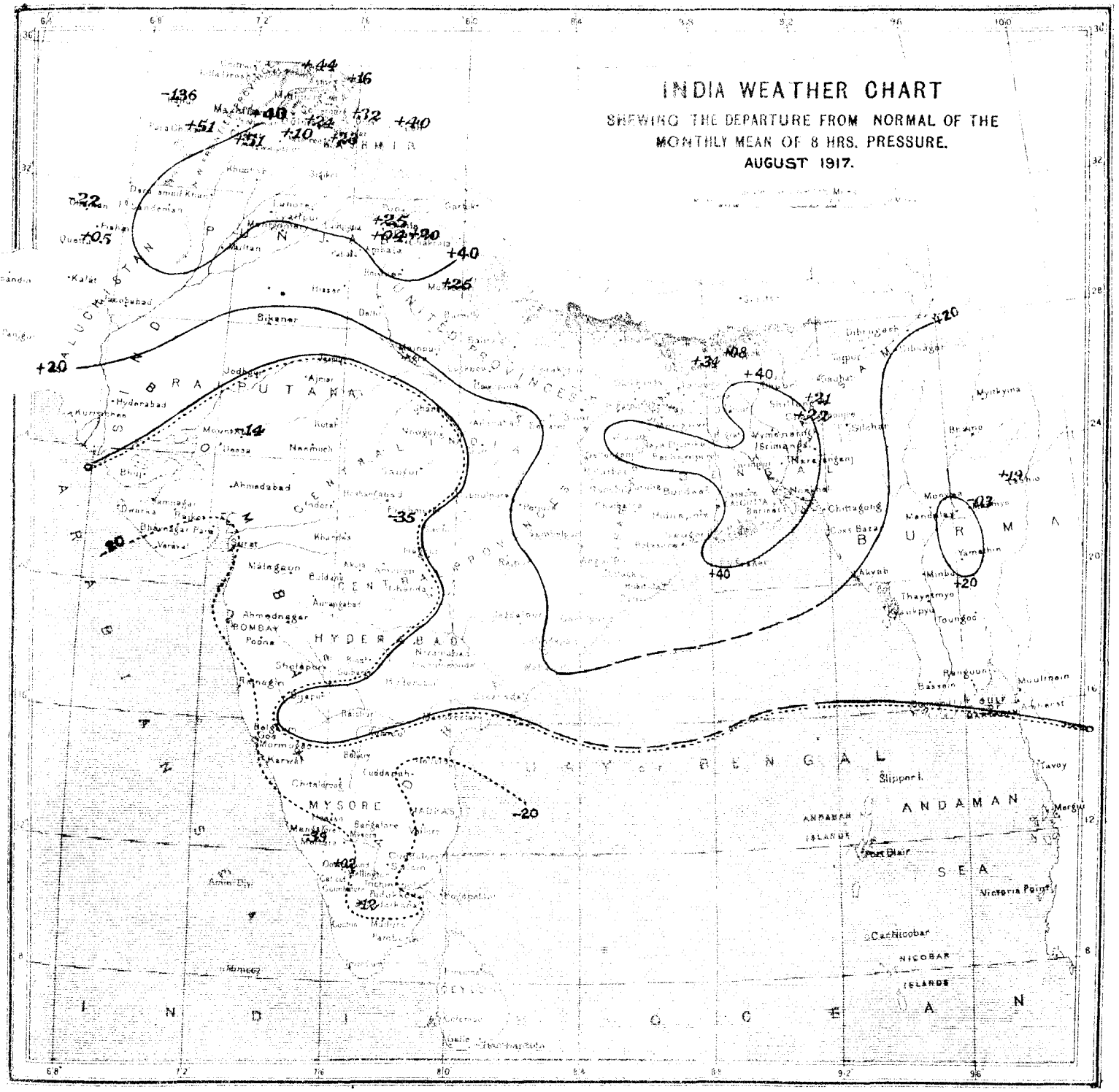


The lines of the above chart represent isobars or lines of equal barometric pressure, the numbers attached indicating the barometric pressure in inches and being drawn for differences of pressure of ·05 inch. The isobars in the Bay of Bengal are filled in by means of the shore observations, and by comparison with the normal distribution of pressure.

The mean 8 hrs. wind directions of the month are shewn by means of arrows flying with the wind, and are calculated by means of Lambert's formula applied to the winds as given in Table B of the 8 hrs. observations. The mean wind directions for the hill stations are indicated by broken arrows to distinguish them from the wind arrows for the plain stations. The mean velocity of the winds during the month is shewn by the following notation:—

Velocity of	0 to 2	miles per	hour	...	one	feather	added to the wind arrow.				
,,	,, 2 to 5	,,	,,	,,	...	two	feathers	,,	,,	,,	,,
,,	,, 5 to 10	,,	,,	,,	...	three	,,	,,	,,	,,	,,
,,	,, 10 to 20	,,	,,	,,	...	four	,,	,,	,,	,,	,,
	over 20	,,	,,	,,	...	five	,,	,,	,,	,,	,,

Wind strengths are based on factor 2·2 for the standard type of Beckley Robinson anemograph, instead of 3·0 as used for this plate up to December 1911 inclusive.



The chart shows the departure from normal of the mean during the month of 8 hrs. pressure by means of lines drawn for equal amounts of departure. The numbers are given in thousandths of an inch, 20 representing '020' or two hundredths of an inch, &c. Continuous lines indicate that the pressure was in excess by amounts indicated by the numbers attached to the lines, and broken or dotted lines that it was in defect by amounts indicated by the numbers attached to the lines. Two parallel lines near to each other, one continuous and the other broken or dotted, represent the line of no departure, the dotted line facing the area of deficient pressure or negative departures.

CHART SHEWING THE DEPARTURE FROM NORMAL
OF THE MONTHLY MEAN OF DAILY
MAXIMUM TEMPERATURE.

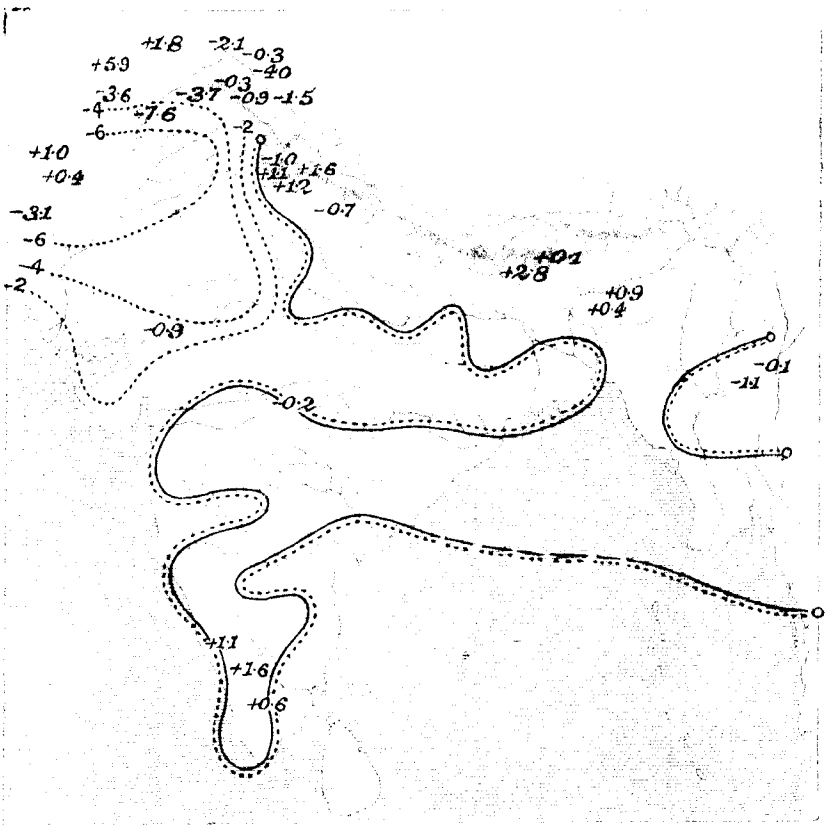


CHART SHEWING THE DEPARTURE FROM NORMAL
OF THE MONTHLY MEAN OF DAILY
MINIMUM TEMPERATURE.

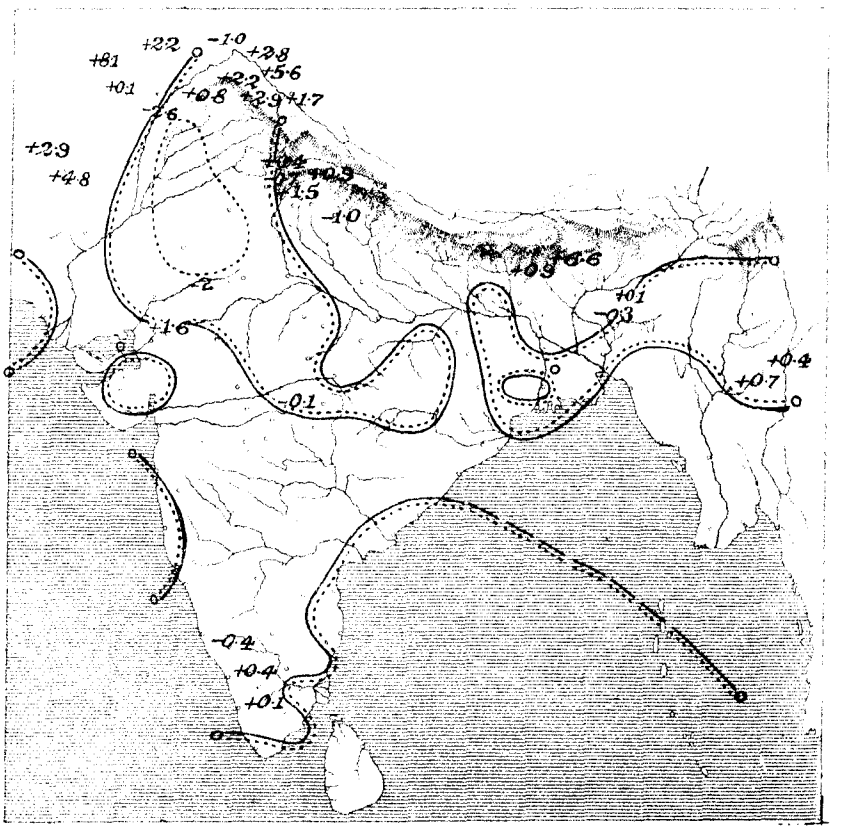


CHART SHEWING THE DEPARTURE FROM NORMAL
OF THE MONTHLY MEAN OF DAILY
MEAN TEMPERATURE.

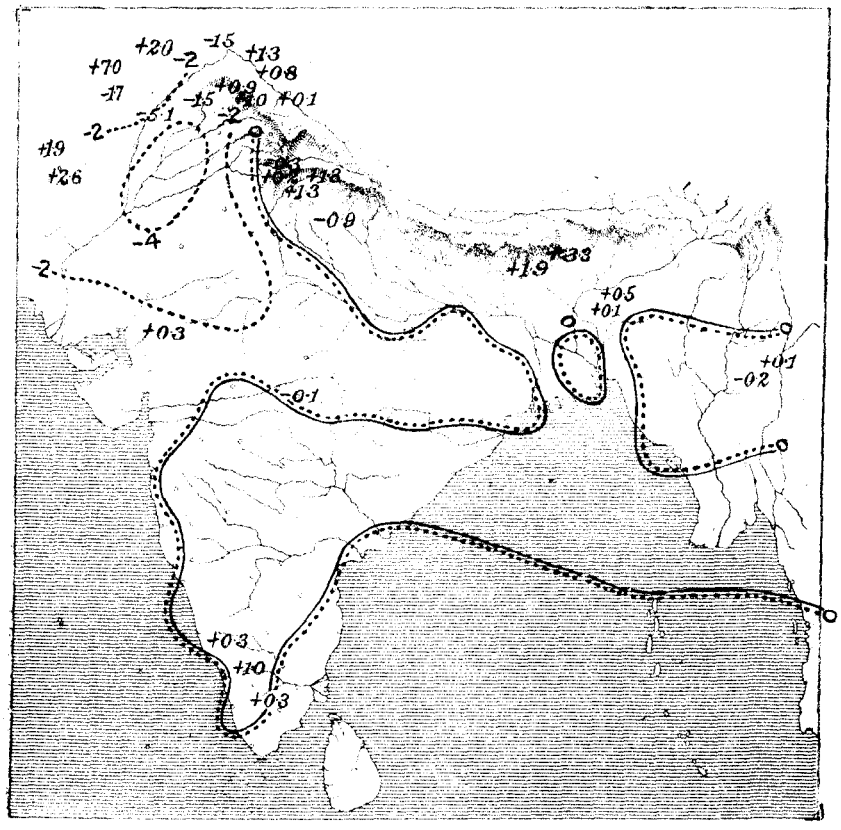


CHART SHEWING THE DEPARTURE FROM NORMAL
OF THE MONTHLY MEAN OF ABSOLUTE
HUMIDITY AT 8 HRS.

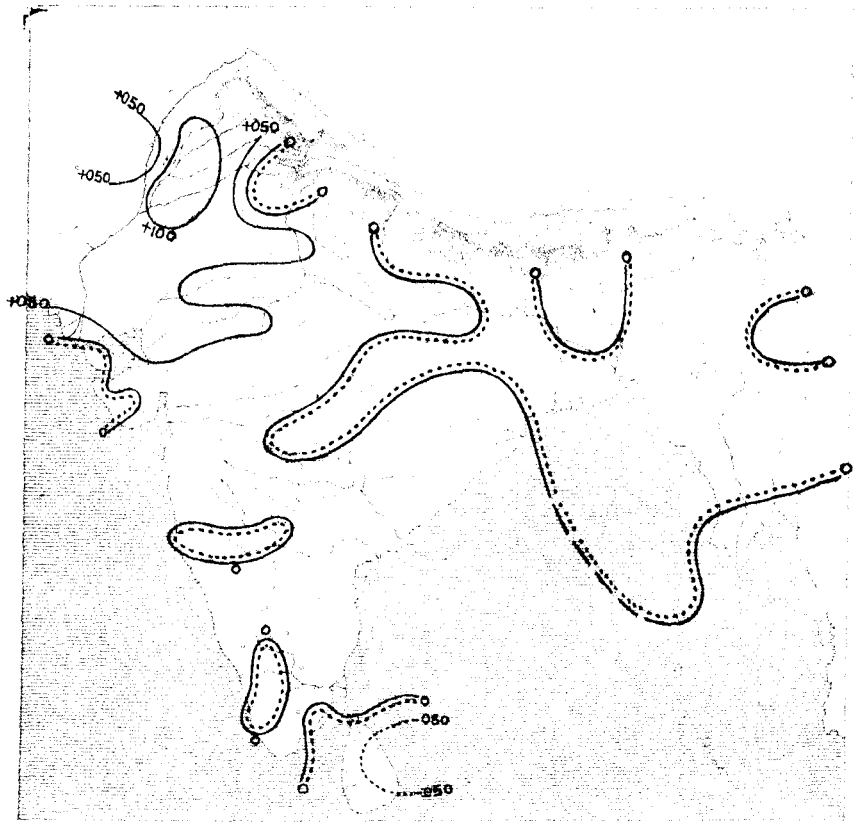


CHART SHEWING THE DEPARTURE FROM NORMAL
OF THE MONTHLY MEAN OF RELATIVE
HUMIDITY AT 8 HRS.

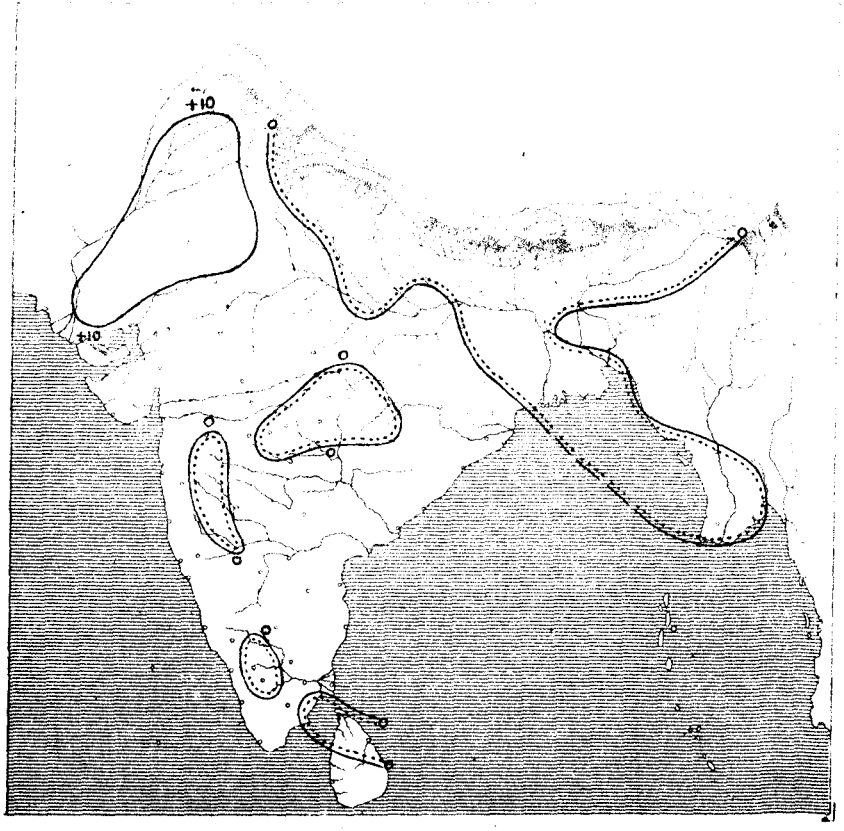


CHART SHEWING THE DEPARTURE FROM NORMAL OF THE MONTHLY MEAN OF CLOUD AMOUNT AT 8 HRS.

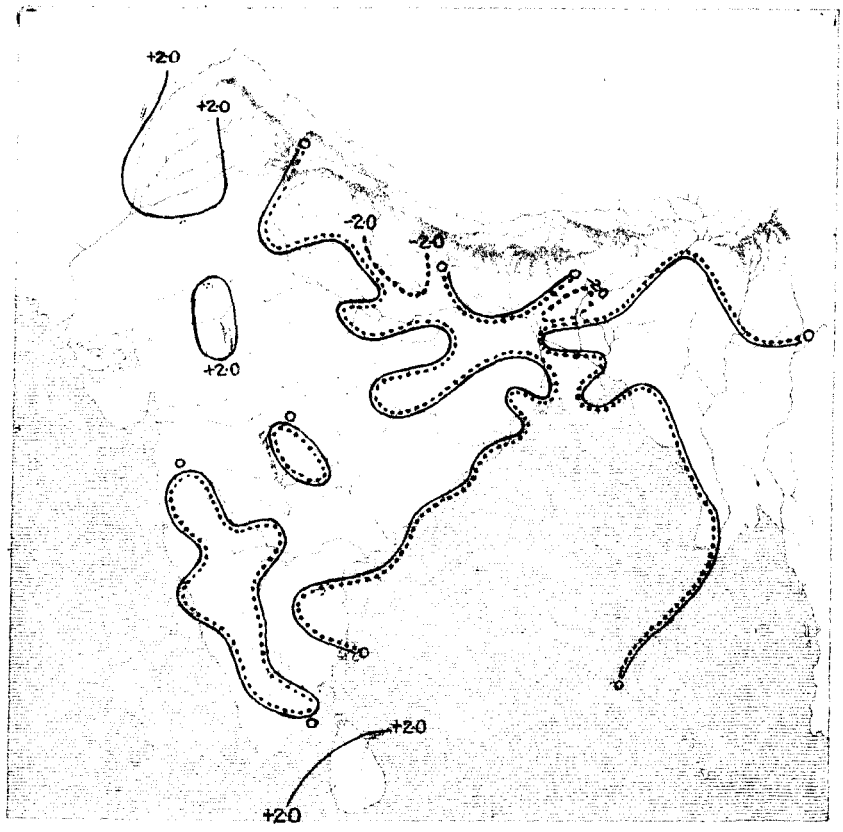
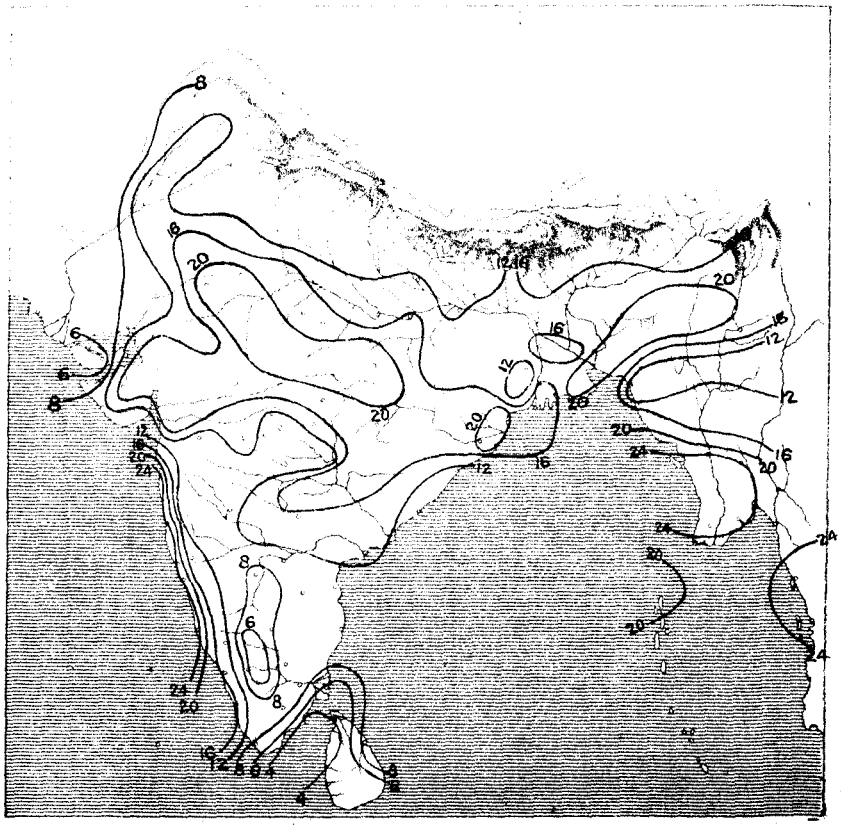
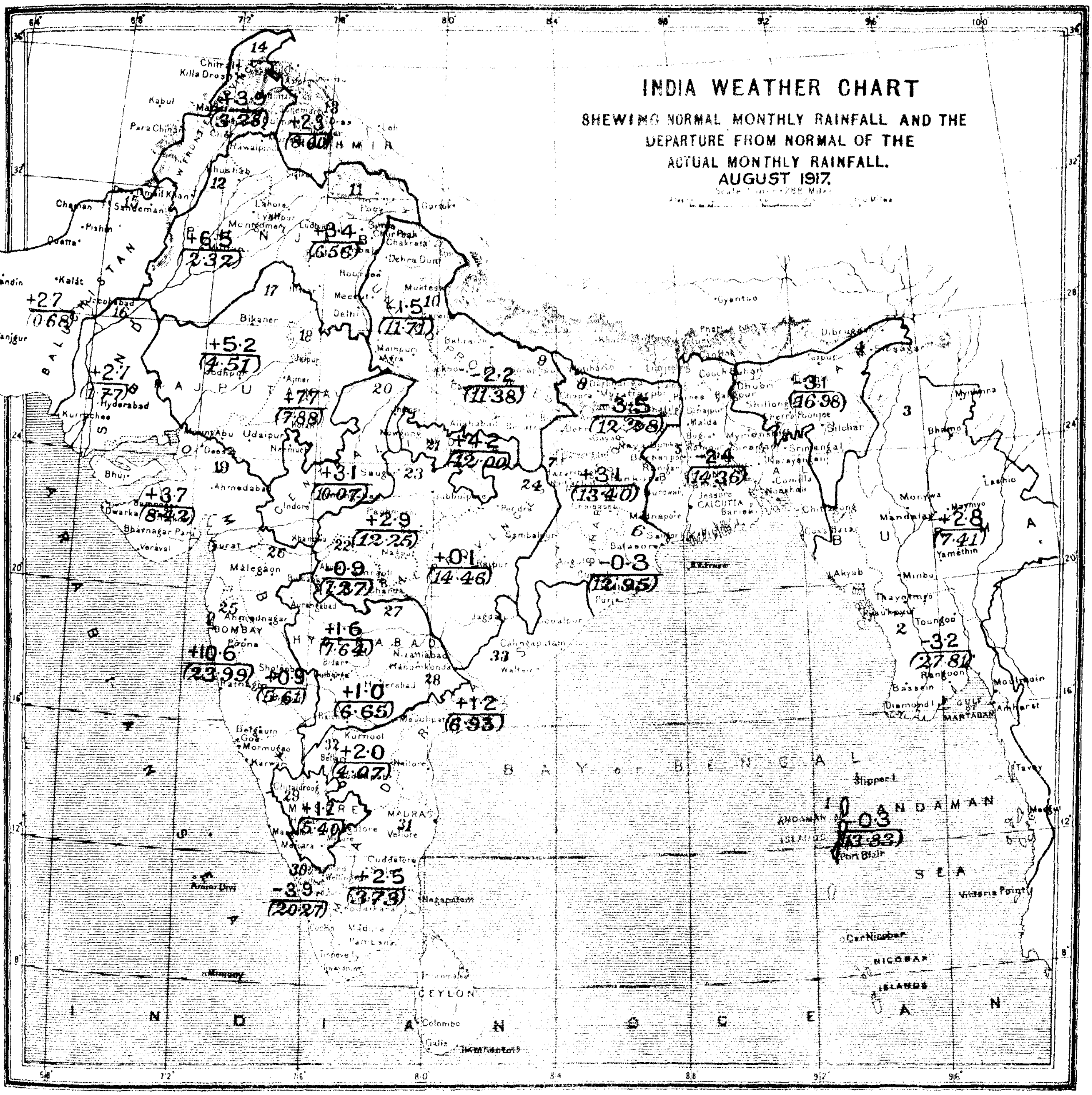


CHART SHEWING THE TOTAL NUMBER OF DAYS IN THE MONTH ON WHICH RAINFALL EQUALLED OR EXCEEDED 0·10 INCH.

(BASED ON THE RETURNS OF TABLE B.)





The country is divided into 33 areas as shewn in the list below. The numbers in that list correspond with the red numbers on the chart, and serve to identify the areas. The numbers in brackets on the chart give the average over the divisions of the normal monthly rainfall, the numbers above these give the departures from normal of the average actual rainfall over the divisions.

1. Bay Islands
2. Lower Burma
3. Upper Burma
4. Assam
5. Bengal
6. Orissa
7. Chota Nagpur
8. Bihar
9. United Provinces, East
10. United Provinces, West
11. Punjab, East and North
12. Do., Southwest
13. Kashmir
14. Northwest Frontier Province
15. Baluchistan
16. Sind
17. Rajputana, West
18. Rajputana, East
19. Gujarat
20. Central India, West
21. Do., East
22. Berar
23. Central Provinces, West
24. Do., East
25. Konkan
26. Bombay, Deccan
27. Hyderabad, North
28. Hyderabad, South
29. Mysore
30. Malabar
31. Madras, Southeast
32. Madras, Deccan
33. Madras Coast, North

Publication has been delayed on account of war conditions.

GOVERNMENT OF INDIA

METEOROLOGICAL DEPARTMENT

MONTHLY WEATHER REVIEW

PUBLISHED BY ORDER OF

THE GOVERNMENT OF INDIA.

CALCUTTA, SEPTEMBER, 1917.

INTRODUCTION.

THIS review of the weather in India during the month of September, 1917, is based on observations taken daily at 8 hrs. at 217 stations, and on additional observations taken at 10 hrs. and 16 hrs. at 11 stations. In the rainfall summary have been utilized the data furnished by the meteorological observatories, and such rainfall statements of the month as had been published by the Provincial Governments up to the date of the preparation of the review.

The brief notes on solar, magnetic and seismic disturbances are supplied by the chief observatories in the Indian area.

For a statement of the methods adopted in recording and tabulating the data, for each of the elements of observation, reference should be made to the introductory portion of the review for January.

Summary of the chief features of the weather in India during the month.

2. The monsoon was exceptionally strong and steady and produced abundant rain over nearly the whole country, but more especially in the normally dry zone of northwest India.

Two disturbances were formed in the Indian area; one over the Bay in the first week and the other near Agra on the 18th; the latter went into the north Punjab and was the cause of some very heavy rain. Its disappearance on the 25th marked the termination of the regular monsoon rains in the Punjab, an event which usually occurs about the middle of the month. In keeping with the excess of rainfall the air was damper, cloud more abundant and temperatures slightly lower than usual over a large part of the country.

Atmospheric pressure averaged over the plains was ·031″ in defect of the normal.

Solar, magnetic and seismic disturbances.

KODAIKANAL OBSERVATORY.

3. *Solar Observations.*—No solar observations could be made on three days during the month and prominences could not be recorded on five days.

Sunspots.—Thirty-seven new groups of spots were observed as against forty-five in August. The daily average number was 7·6 and the average life of a spot was 5·4 days, the averages for the preceding month being 8·8 and 5·8 respectively. The distribution of the spots in latitude was as follows:—

TABLE 1.

—	0°—10°	11°—20°	21°—30°	Mean latitude.	Extreme latitudes.
North . . .	6	10	3	13°·8	6° & 27°
South . . .	5	7	6	16°·2	8° & 27°

Prominences.—Seventy large and two metallic prominences were observed during the month. The highest was 180″ and was observed on the 26th at latitude +45° east.

Magnetic disturbances.—One "great" disturbance was recorded from the 5th to 6th and "moderate" disturbances on the 9th, 19th and from 28th to 30th.

J. EVERSHED,
Director,
Kodaikanal and Madras Observatories.

Seismic records.

$\phi = 10° 13' 50''$ N; $\lambda = 77° 28' 00''$ E; $h = 2{,}343$ m.
Subsoil Rock.

Apparatus.—Milne's Horizontal Pendulum Seismograph.

TABLE 2.

	V	To	ϵ	r/To²
AN:				
AE:	9·76	17·6	1	2·8
AZ:				

Date.	Phase.	Time, G. M. T.	Period (Sec.).	Amplitude (u). An.	Ae.	Az.	Distance Δ (Km.).	Remarks.
1917.		h. m. s.						
Sept. 15th	e P	10 07 42	...	...	...	...	...	Widening of line.
	F	10 19 30	...	...	...	...	...	
„ 17th	e L	20 18 00	...	...	...	...	...	No preliminary tremors.
	M	20 20 12	...	...	50	...	...	
	F	20 25 54	...	...	...	...	...	
„ 20th	e P	3 39 24	...	...	...	...	...	Widening of line.
	F	4 05 18	...	...	...	...	...	
„ 26th	e P	22 13 30	...	...	...	...	...	Widening of line.
	F	22 14 36	...	...	...	...	...	

J. EVERSHED,
Director,
Kodaikanal and Madras Observatories.

BOMBAY OBSERVATORY.

Alibag magnetic record.

4. During the month of September 1917 the traces showed 16 calm days, 13 days of small, and 1 day of moderate disturbance.

The days of the month selected as "quiet" for the purposes of the Magnetic Survey of India are the 1st, 11th, 17th, 23rd and 26th.

The following table represents the magnetic character of each day during the month.

TABLE 3.

Day.	Character.	Day.	Character.	Day.	Character.	Day.	Character.
1	C	9	S	17	C	25	C
2	S	10	C	18	C	26	C
3	S	11	C	19	S	27	C
4	S	12	C	20	S	28	S
5	M	13	S	21	S	29	S
6	S	14	C	22	C	30	S
7	C	15	C	23	C		
8	C	16	C	24	S		

C = calm; S = small; M = moderate; G = great; V. G. = very great.

The mean observed absolute values of the several magnetic elements reduced to the mean monthly tabulations of the magnetograms, as also the ranges and the summed ranges of the horizontal force and the declination for the month are as follows:—

Easterly declination	0° 31′ 41″.
Horizontal force	0·36877 C. G. S. unit.
Vertical force	0·16902 C. G. S. unit.
Inclination	24° 37′·4.
Horizontal force range	0·00059 C. G. S. unit.
Horizontal force summed range	0·00404 C. G. S. unit.
Declination range	6′·1.
Declination summed range	22′·8.

(NOTE.—Summed range means sum without regard to sign of twenty-four ordinates of the diurnal inequality.)

Seismic records.

$\phi = 18° 53' 36''$N; $\lambda = 72° 48' 56''$; $h = 11$m.
Subsoil Trap.

Apparatus.—Milne's Horizontal Pendulum Seismograph.

TABLE 4.

	V	To	ϵ	r/To²
AN:				
AE:	9	19	·1	
AZ:				

Date.	Phase.	Time, G. M. T.	Period (Sec.)	Amplitude (u). An.	Ae.	Az.	Distance △ (Km.).	Remarks.
1917.		h. m. s.						
Sept. 4th	P	16 48 29	...	...	...	...	...	
	M	16 58 11	...	...	56	...	...	
	F	17 11 11	...	...	...	...	...	
„ 15th	P	9 44 50	...	...	...	...	...	
	M	10 8 32	...	...	44	...	...	
	F	10 27 41	...	...	...	...	...	
„ 17th	P	...	...	...	...	...	...	Beginning mixed in tremors.
	M	22 28 46	...	...	44	...	...	
	F	...	...	...	...	...	...	End mixed in tremors.
„ 24th	P	*20 20 3	...	...	...	...	...	
	S	20 29 50	...	...	...	...	...	
	M	20 31 3	...	...	11	...	...	
	F	...	...	...	...	...	...	End uncertain.
„ 28th	...	m. m. 23 36 to 38	...	...	...	...	...	Thickening of line.

Sensibility to tilt 1·0 mm. of amplitude on the trace = 0·32″.

* This time is as shown by the float record. (Tilt Seismograph).

N. A. F. MOOS,

Director,

Bombay and Alibag Observatories.

5. CALCUTTA (ALIPORE) OBSERVATORY.

Seismic records.

$\phi = 22° 32' N$; $\lambda = 88° 20' E$; $h = 6{\cdot}4$m. *Subsoil Alluvial.*

Apparatus.—Two Omori Ewing Horizontal Pendulum Seismographs.

TABLE 5.

	V	To	∈	$\frac{r}{To^2}$
AN:	29	18	1	
AE:	29	42	1	
AZ:				

Date.	Phase.	Time, G. M. T.	Period (Sec.).	Amplitude (u). An.	Ae.	Az.	Distance △ (Km.)	Remarks.
1917.		h. m. s.						
Sept. 4th	P	16 46 18	3	...	..	...	...	
	S	16 49 54	5	...	...	...	...	
	L	16 55 30	7	...	...	...	...	
	F	17 14 12	...	...	..	...	...	

6.—SIMLA OBSERVATORY.

The Seismographs at the Simla Meteorological Office were dismantled in July 1917 and were set up again in a new building in October 1917.

The following table contains a list of earthquakes that were reported:—

TABLE 6.

Place at which felt.	Date.	G. M. T. of earthquakes.	Duration.	Intensity Rossi-Forel scale.	No. of shocks.	Remarks.
		h. m.	sec.			
Shillong . .	Sept. 7th	9 50	1	5	1	
Poo (Bashahr State Simla District).	„ 11th	15 11	3	4	1	
Drosh . . .	„ 14th	0 5	6	7	2	
Chittagong . .	„ 14th	0 10	5	6	1	
Shillong . .	„ 18th	1 15	1	5	1	
Gulmarg (Kashmir)	„ 18th	15 30	25	6	3	
Ditto ...	„ 19th	8 22	10	6	1	
Shillong . .	„ 22nd	13 6	1	5	1	
Hukitala . .	„ 22nd	17 15	4	3	1	
Gopalpur . .	„ 22nd	18 00	3	3	1	
Waltair . .	„ 22nd	18 00	15	6	3	
Drosh . . .	„ 23rd	9 40	10	7	3	

Solar radiation.—Observations were not recorded owing to absence of officers on war service.

C. W. B. NORMAND,

Imperial Meteorologist, Simla.

Weather in the Indian Ocean.

7. Barometric pressure and rainfall were in appreciable defect. Winds were nearly normal as regards direction, but their velocity was high at Mauritius and Seychelles and low at Zanzibar.

Conditions were thus favourable to the prevalence of a strong monsoon over the land area of India.

TABLE 7.

—	Mauritius.*	Zanzibar.	Seychelles.
Departure from normal of mean pressure	—·025	—·019	—·033
Actual mean wind direction . .	S 62° E	S 5° W	S 27° E
Normal mean wind direction . .	S 77° E	S 5° E	S 40° E
Actual mean wind velocity (miles per diem).	291	62	245
Normal mean wind velocity (miles per diem).	211	98	210
Rainfall departure from normal . .	—0·47	—0·06	—0·93

* Approximate data derived from weekly telegrams.

Depressions and cyclonic storms.

8. An area of squally weather which lay off the north Madras coast on the 4th developed on the 5th into a slight depression about 200 miles to the southeast of Gopalpur. The depression began to move on the 6th, crossed the coast to the north of that station on that night, and travelling roughly in a westnorthwesterly direction disappeared in Baluchistan on the 12th. It caused widespread and at places heavy rain along its track.

Another disturbance formed in the Bay about the end of the month; details about it will be given in the Monthly Weather Review for October 1917.

A depression which had formed near Agra on the morning of the 19th moved westwards and lay in the neighbourhood of Jaipur and Bikaner on the next two days. It took a northerly course on the 22nd and was near Montgomery on the morning of the 23rd by which time it had concentrated into a cyclonic storm. The centre lay to the west of Sialkot on the morning of the 24th and the storm broke up against the Punjab hills on the 25th. Some very heavy falls of rain occurred in its track and are given in the following table.

TABLE 8.

Province.	District or State.	Station.	Amount received during 24 hrs. preceding 8 hrs. of					
			20th.	21st.	22nd.	23rd.	24th.	25th.
			"	"	"	"	"	"
United Provinces . .	Agra	Firozabad . . .	6·50	...	...	...	...	...
Ditto . .	Mainpuri . . .	Shikohabad . . .	7·00	...	...	...	...	...
Ditto . .	Etah	Aliganj . . .	6·65	...	...	...	...	...
Rajputana . . .	Alwar	Thana Ghazi . . .	7·70	...	...	...	...	...
Ditto . . .	Do.	Mandwar . . .	...	7·12	...	...	...	...
Ditto . . .	Do.	Tijara	...	7·25	...	...	...	...
Ditto . . .	Bikaner . . .	Nohar	...	7·80	...	...	...	...
Ditto . . .	Bharatpur . . .	Paharee . . .	...	7·00	...	...	...	...
Punjab	Gurgaon . . .	Khol	...	11·15	...	...	...	...
Do.	Do. . . .	Firozpur . . .	...	9·79	...	...	...	...
Do.	Kangra . . .	Dharamsala . . .	...	14·00	...	...	...	...
Do.	Hissar	Hissar	...	...	8·00	...	...	...
Do.	Do.	Hansi	...	...	6·75	...	...	...
Do.	Do.	Sirsa	...	...	6·51	...	...	...
Do.	Lahore . . .	Van	...	...	...	8·88	...	...
Do.	Do. . . .	Chunian . . .	...	...	...	8·61	...	...
Do.	Montgomery . .	Montgomery . . .	...	...	...	7·96	...	...

Province.	District or State.	Station.	Amount received during 24 hrs. preceding 8 hrs. of					
			20th.	21st.	22nd.	23rd.	24th.	25th.
			"	"	"	"	"	"
Punjab	Montgomery	Gugera	...	...	...	6·90	...	...
Do.	Lyallpur	Jaranwala	...	...	...	7·37	...	...
Do.	Amritsar	Taran Taran	...	...	...	...	7·95	...
Do.	Sialkot	Sialkot	...	...	...	...	6·64	...
Do.	Gujranwala	Gujranwala	...	...	...	...	6·54	...
Do.	Gujrat	Gujrat	...	...	...	...	6·45	...
Kashmir	Jammu	Akhnur	...	...	...	...	...	9·79

Depressions of the cold weather type appeared frequently during the month and had the effect of stimulating the activity of the monsoon in northwest India.

Pressure.

9. Barometric pressure was in defect over the whole country with the exception of Bihar, Bengal, Assam and the interior of Burma. The deficiency was large in Malabar, the Bombay Presidency, lower Sind, Rajputana and the west of Central India and of the Central Provinces with its maximum value over Gujarat where it averaged about ·08″ in amount. In consequence of these anomalous features in the distribution, the monsoon trough of low pressure lay further south than usual.

TABLE 9.

Division.	Departure from normal of mean 8 hrs. pressure.
	"
Burma	+·007
Assam	+·018
Bengal	+·005
Bihar and Orissa	—·007
United Provinces	—·021
Punjab	—·018
North-West Frontier Province	—·015
Sind	—·056
Rajputana	—·065
Bombay	—·072
Central India	—·057
Central Provinces	—·052
Hyderabad	—·038
Mysore	—·042
Madras	—·036

The vertical gradient was somewhat steeper than usual in northwest and central India, and of about the normal value in northeast India and the south of the Peninsula.

TABLE 10.

Hill station.	Departure from normal pressure. A	Plain station.	Departure from normal pressure. B	Departure of pressure difference. B—A.
	"		"	"
Quetta	—·057	Jacobabad	—·038	+·019
Leh	—·024	Lahore	—·019	+·005
Murree	—·046	Peshawar	—·029	+·017
Simla	—·025	Ludhiana	—·014	+·011
Mukteswar	—·024	Bareilly	—·019	+·005
Darjiling	+·011	Dhubri	+·010	—·001
Mount Abu	—·080	Deesa	—·076	+·004
Pachmarhi	—·088	Khandwa	—·065	+·023
Kodaikanal	—·035	Madura	—·034	+·001

Temperature.

10. Maximum temperature was below the average over nearly the whole country, but the defect was less than 3° in amount in all the divisions with the exception of the Punjab (7½°), Rajputana (6½°), Sind (4½°), the North-West Frontier Province (4°) and the United Provinces (3½°). Minimum temperature was higher than usual by 6° in Baluchistan, 5° in Kashmir and 3½° in the North-West Frontier Province, and was very nearly normal elsewhere.

TABLE 11.

SUB-DIVISION.	ACTUAL TEMPERATURE.				DEPARTURE FROM NORMAL OF		
	Mean maximum.	Mean minimum.	Monthly mean of mean between maximum and minimum.	Mean daily range of temperature.	Maximum.	Minimum.	Daily range.
	°	°	°	°	°	°	°
1. Bay Islands	83·8	75·9	79·9	7·9	—0·9	—0·7	—0·2
2. Lower Burma	84·5	74·4	79·5	10·1	—0·7	—1·1	+0·4
3. Upper Burma	88·4	74·2	81·3	14·2	—1·5	—0·7	—0·8
4. Assam	88·1	75·8	82·0	12·3	—0·4	—0·4	0
5. Bengal	87·4	77·1	82·2	10·3	—0·9	—0·7	—0·2
6. Orissa	87·8	77·5	82·7	10·3	—1·3	—0·3	—1·0
7. Chota Nagpur	87·1	74·6	80·9	12·5	—1·2	—0·1	—1·1
8. Bihar	88·3	77·3	82·8	11·0	—1·4	—0·5	—0·9
9. United Provinces, East	87·9	76·9	82·4	11·0	—3·3	—0·1	—3·2
10. Do. do., West	88·0	76·2	82·1	11·9	—3·8	+0·5	—4·3
11. Punjab, East and North	87·7	74·7	81·2	13·0	—7·1	+0·6	—7·7
12. Do., Southwest	91·3	76·1	83·7	15·3	—8·4	—0·2	—8·2
13. Kashmir	77·1	56·5	66·8	20·7	+0·8	+5·0	—4·2
14. North-West Frontier Province	93·5	76·3	84·9	17·2	—4·3	+3·5	—7·8
15. Baluchistan	91·2	63·0	77·1	28·2	—0·7	+6·2	—6·9
16. Sind	91·1	77·9	84·5	13·1	—4·5	+1·9	—6·4
17. Rajputana, West	89·5	76·5	83·1	13·1	—6·9	—0·7	—6·2
18. Do., East	86·0	74·7	80·4	11·3	—6·3	—0·2	—6·1
19. Gujarat	87·0	75·6	81·3	11·4	—2·9	+0·6	—3·5
20. Central India, West	83·9	71·8	77·9	12·1	—2·6	+1·3	—3·9
21. Do. do., East	86·2	76·1	81·1	10·1	—2·7	+1·2	—3·9
22. Berar	84·6	71·8	78·2	12·8	—2·1	+0·4	—2·5
23. Central Provinces, West	84·8	72·9	78·9	11·9	—2·3	+0·4	—2·7
24. Do. do., East	85·2	72·7	78·9	12·5	—1·6	+0·2	—1·8
25. Konkan	82·9	75·3	79·1	7·6	—0·8	+0·1	—0·9
26. Bombay Deccan	83·3	69·1	76·2	14·3	—2·0	+0·3	—2·3
27. Hyderabad, North	83·6	69·6	76·6	14·0	—2·0	0	—2·0
28. Do., South	86·1	72·4	79·2	13·7	—1·4	—0·2	—1·2
29. Mysore	81·1	66·8	74·0	14·3	—1·3	+1·0	—2·3
30. Malabar	83·1	74·5	78·8	8·5	—0·8	+0·3	—1·1
31. Madras, South-east	90·3	75·2	82·7	15·0	—2·6	0	—2·6
32. Do., Deccan	89·0	73·9	81·4	15·1	—1·6	+0·3	—1·9
33. Do. Coast, North	88·0	77·1	82·5	10·9	—2·5	—1·0	—1·5

TABLE 12.

Division.	Departure from normal of		
	Mean maximum temperature.	Mean minimum temperature.	Mean temperature.
	°	°	°
Burma	−1·1	−0·9	−1·0
Assam	−0·4	−0·4	−0·4
Bengal	−0·9	−0·7	−0·7
Bihar and Orissa	−1·3	−0·4	−0·8
United Provinces	−3·5	+0·2	−1·7
Punjab	−7·4	+0·4	−3·5
North-West Frontier Province	−4·3	+3·5	−0·4
Sind	−4·5	+1·9	−1·3
Rajputana	−6·6	−0·4	−3·5
Bombay	−2·2	+0·4	−0·9
Central India	−2·7	+1·3	−0·7
Central Provinces	−2·1	+0·4	−0·9
Hyderabad	−1·7	−0·1	−0·9
Mysore	−1·3	+1·0	−0·1
Madras	−2·1	−0·2	−1·2

Winds.

11. (*a*) On the whole the Arabian Sea current was neither so strong nor so steady as usual, while the Bay current, although of about the average strength, was very steady.

(*b*) The direction of air movement was unusual in most places, but more especially in the Indo-Gangetic Plain.

TABLE 13.

Station.	Wind direction.	
	Actual.	Normal.
	°	°
Gaya	S 59 E	S 37 W
Benares	S 60 E	S 31 W
Allahabad	N 83 E	N 63 W
Sutna	E	N 69 W
Cawnpore	S 70 E	S 45 W
Mainpuri	S 72 E	S 86 W
Agra	N 77 E	S 59 W
Delhi	S 83 E	S 85 W
Hissar	S 66 E	S 59 W
Montgomery	S 72 E	S 4 W

TABLE 14.

Division.	Departure from normal of	
	Hourly wind velocity.	Wind steadiness.
Burma	+0·2	− 6
Assam	+0·2	+17
Bengal	−0·7	+ 1
Bihar and Orissa	+0·1	+10
United Provinces	−0·2	+32
Punjab	+0·6	+ 8
North-West Frontier Province	−0·7	−19
Sind	−2·9	− 5
Rajputana	−1·7	−31
Bombay	−1·0	−13
Central India	−1·3	−11
Central Provinces	−0·2	− 5
Hyderabad	−0·9	+ 3
Mysore	−0·4	−13
Madras	0	−10

Humidity and cloud.

12. The air was much damper than usual, both absolutely and relatively, in the Punjab, the North-West Frontier Province, Baluchistan, Sind, Rajputana, Central India, east Gujarat and the west of the United Provinces, but over the rest of the country the hygrometric conditions were very nearly normal.

The distribution of cloud resembled closely that of relative humidity. The sky was covered to about the customary extent along the coast from Diamond Island to Chittagong, in Assam, Bengal, Mysore and Madras excluding Malabar and was unusually cloudy in almost all other parts of the country. In the Punjab and the North-West Frontier Province the recorded amount was more than double the normal.

TABLE 15.

DIVISION.	HYGROMETRY; 8 HRS.				CLOUD.	
	Mean humidity.	Departure from normal.	Mean vapour tension in inches of mercury.	Departure from normal in inches of mercury.	Mean cloud amount at 8 hrs.	Departure from normal.
	%					
Burma . . .	91	+ 1	·864	—·024	7·8	+0·5
Assam . . .	90	0	·901	—·021	6·7	—0·4
Bengal . .	89	+ 1	·930	—·023	6·7	+0·3
Bihar and Orissa .	88	+ 3	·914	+·010	7·3	+1·7
United Provinces .	88	+ 7	·903	+·044	6·4	+2·6
Punjab . .	87	+17	·870	+·125	5·6	+3·5
North-West Frontier Province.	82	+15	·857	+·160	4·1	+3·0
Sind . . .	82	+ 9	·875	+·094	3·5	+1·2
Rajputana .	86	+16	·839	+·106	6·7	+3·3
Bombay . .	88	+ 6	·823	+·035	7·1	+1·8
Central India .	91	+ 8	·839	+·054	8·1	+2·9
Central Provinces .	88	+ 5	·803	+·057	7·8	+2·2
Hyderabad . .	85	+ 5	·746	+·032	7·3	+1·4
Mysore . .	86	+ 3	·645	+·012	7·8	—0·1
Madras . .	83	+ 5	·837	+·022	6·4	+0·5

Rainfall.

13. The rainfall of the month was unusually abundant over by far the greater part of the country. Thus the total fall was more or less above normal in all the divisions with the exception of Bengal where it was only 11 per cent short of the average. The excess ranged between 3″ and 7″ in the United Provinces, Sind, Bombay, Central India, the Central Provinces, Hyderabad and Mysore and was as much as 8½″ in Rajputana and 8¼″ in the Punjab. In Baluchistan where normally only fourteen cents occur the month's fall amounted to about 1½″, while in Kashmir the recorded quantity was 98 per cent above the average.

The month's rainfall averaged over the whole of the plains exceeded the normal by 4·1″ or 60 per cent.; this is the largest excess ever recorded in September since 1875.

TABLE 16.

SUB-DIVISION.	NUMBER OF RAINY DAYS.		RAINFALL.			
	Actual.	Normal.	Actual.	Normal.	Departure from normal.	Percentage departure from normal.
			″	″	″	
1. Bay Islands	21·0	18·4	13·73	15·19	—1·46	— 10
2. Lower Burma	19·8	19·6	19·53	18·70	+0·83	+ 4
3. Upper Burma	13·2	10·9	10·08	8·26	+1·82	+ 22
4. Assam	14·2	13·6	13·13	12·21	+0·92	+ 8
5. Bengal	14·1	12·4	10·20	11·45	—1·25	— 11
6. Orissa	14·8	12·0	9·58	9·43	+0·15	+ 2
7. Chota Nagpur	13·5	10·6	9·00	8·67	+0·33	+ 4
8. Bihar	12·8	9·2	10·78	8·64	+2·14	+ 25
9. United Provinces, East	13·6	7·3	11·90	6·67	+5·23	+ 78
10. Do. do., West	13·4	5·8	12·81	5·62	+7·19	+128
11. Punjab, East and North	11·0	3·2	12·59	3·24	+9·35	+289

Sub-division.	Number of rainy days.		Rainfall.			
	Actual.	Normal.	Actual.	Normal.	Departure from normal.	Percentage departure from normal.
			"	"	"	
12. Punjab, Southwest	6·6	1·3	6·09	1·02	+5·07	+ 497
13. Kashmir	8·1	4·2	9·06	4·57	+4·49	+ 98
14. North-West Frontier Province	4·2	2·0	2·79	1·28	+1·51	+ 118
15. Baluchistan	2·3	0·3	1·41	0·14	+1·27	+ 907
16. Sind	5·6	0·6	5·69	0·45	+5·24	+1164
17. Rajputana, West	9·3	2·3	8·60	2·11	+6·49	+ 308
18. Do., East	13·8	4·8	12·06	4·08	+7·98	+ 196
19. Gujarat	12·7	5·6	11·58	4·74	+6·84	+ 144
20. Central India, West	13·2	7·2	10·63	5·89	+4·74	+ 80
21. Do., East	13·0	6·9	9·20	6·69	+2·51	+ 38
22. Berar	14·1	7·9	10·08	5·81	+4·27	+ 73
23. Central Provinces, West	17·1	9·5	14·11	7·80	+6·31	+ 81
24. Do., East	14·8	9·6	11·20	8·00	+3·20	+ 40
25. Konkan	21·7	15·5	23·80	12·60	+11·20	+ 89
26. Bombay Deccan	11·7	8·2	9·04	5·63	+3·41	+ 61
27. Hyderabad, North	15·3	10·0	13·13	8·31	+4·82	+ 58
28. Do., South	10·8	9·7	9·46	6·97	+2·49	+ 36
29. Mysore	14·3	7·9	10·40	4·95	+5·45	+ 110
30. Malabar	19·6	13·6	19·14	9·23	+9·91	+ 107
31. Madras, Southeast	8·3	6·1	5·84	4·45	+1·39	+ 31
32. Do., Deccan	11·0	7·6	8·51	5·37	+3·14	+ 58
33. Do. Coast, North	12·7	9·3	9·44	6·93	+2·51	+ 36

TABLE 17.

Division.	Rainfall.			
	Actual.	Normal.	Departure from normal.	Percentage departure from normal.
	"	"	"	
Burma	13·79	12·36	+1·43	+ 12
Assam	13·13	12·21	+0·92	+ 8
Bengal	10·20	11·45	—1·25	— 11
Bihar and Orissa	10·04	8·85	+1·19	+ 13
United Provinces	12·39	6·11	+6·28	+103
Punjab	10·92	2·69	+8·23	+306
North-West Frontier Province	2·79	1·28	+1·51	+118

Division.	Rainfall.			
	Actual.	Normal.	Departure from normal.	Percentage departure from normal.
	"	"	"	
Sind	5·69	0·45	+5·24	+1164
Rajputana	11·04	3·50	+7·54	+215
Bombay	11·78	6·59	+5·19	+ 79
Central India	9·93	6·29	+3·64	+ 58
Central Provinces	11·86	7·32	+4·54	+ 62
Hyderabad	11·39	7·68	+3·71	+ 48
Mysore	10·40	4·95	+5·45	+110
Madras	8·44	5·73	+2·71	+ 47
Mean of India	11·05	6·91	+4·14	+ 60

Snowfall.

14. I.—AFGHANISTAN. } No reports have been received.
II.—NORTH-WEST FRONTIER PROVINCE. }

III.—KASHMIR.

(*a*) *Srinagar.*—There was no snowfall in or near the station during the month.

(*b*) *Gulmarg.*—Snowstorms were noticed on the 24th and 29th on the surrounding higher mountains.

(*c*) *Skardu.*—There was slight snowfall on the higher mountains on the 7th, but this melted away soon. Other falls occurred on all the mountains surrounding the station between the 23rd and 26th, and on the 28th and 29th, the depths being two to three inches on the lower mountains and four to five inches on the highest mountains. The depth of snow left unmelted on the last day of the month was about a foot on the mountains near the station.

(*d*) *Dras.*—Snow fell on the tops of the surrounding hills on the 25th, 29th and 30th.

(*e*) *Kargil.*—During the month snowfalls occurred on the mountains near Kargil as given in the table below :—

TABLE 18.

Date.	Name of mountains.	Depth of snowfall.	What portion of the mountains were covered.
		Inches.	
12th	Archulla and Nakthulla	1	Only the peaks.
24th	Archulla, Nakthulla and Samenulla.	1	Only the peaks.
25th	Archulla, Nakthulla, Pazgolla, Barulla, Narainulla and Samenulla.	1 to 5	Upper ¼ of these mountains.
29th and 30th	Archulla, Nakthulla, Pazgolla, Barulla, Narainulla, Samenulla and other mountains near the station.	2 to 12	Upper ½ to ¾ of these mountains.

At the end of month the depth of unmelted snow was as follows :—

Archulla	...	...	...	18 inches
Nakthulla	...	...	...	6 „
Samenulla	...	...	...	3 „
Pazgolla	...	...	...	3 „
Narainulla	...	...	...	2 „
Barulla	...	...	...	1 „

IV.—PUNJAB.

Kilba (*Simla Hills*).—Snowfalls occurred on elevations of 11,000 feet and upwards between the 16th and 19th and on the 23rd, 24th, 29th and 30th; on the last mentioned date the fall amounted to two inches.

V.—The UNITED PROVINCES.

Almora.—The aggregate fall of the month was estimated at about 5¾ feet in Malla Darma, 2½ feet in Malla Johar and 1½ feet in Chaudas. The snowline descended from the line of perpetual snows to a distance of half a mile in Chaudas and 3 miles in Malla Darma.

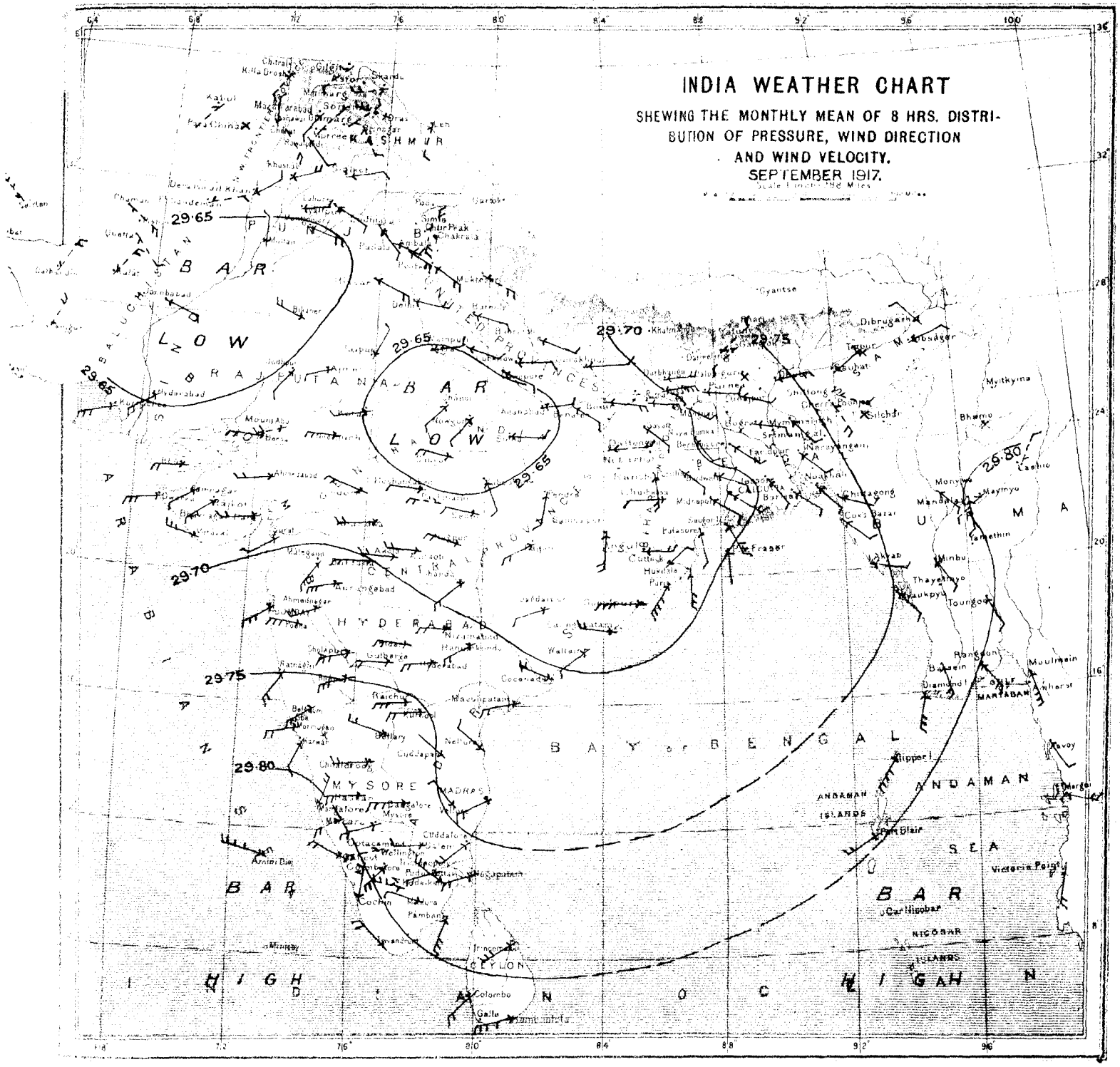
TABLE 19.

Name of pass or peak.	DEPTH OF ACCUMULATION AT THE END OF THE MONTH.	
	Reported.	Normal.
	Feet.	Feet.
Nuwe Pass	16	22½
Untadhura	5½	7½
Ralamdhura	5½	4¾
Milandhura	5½	11¼
Bagdwar	5½	?
Binkaru pass	4	9

SUMMARY.

15. The snowfall of the month was heavier than usual in Kashmir, but was lighter in Almora and the Punjab Himalayas.

HEM RAJ.

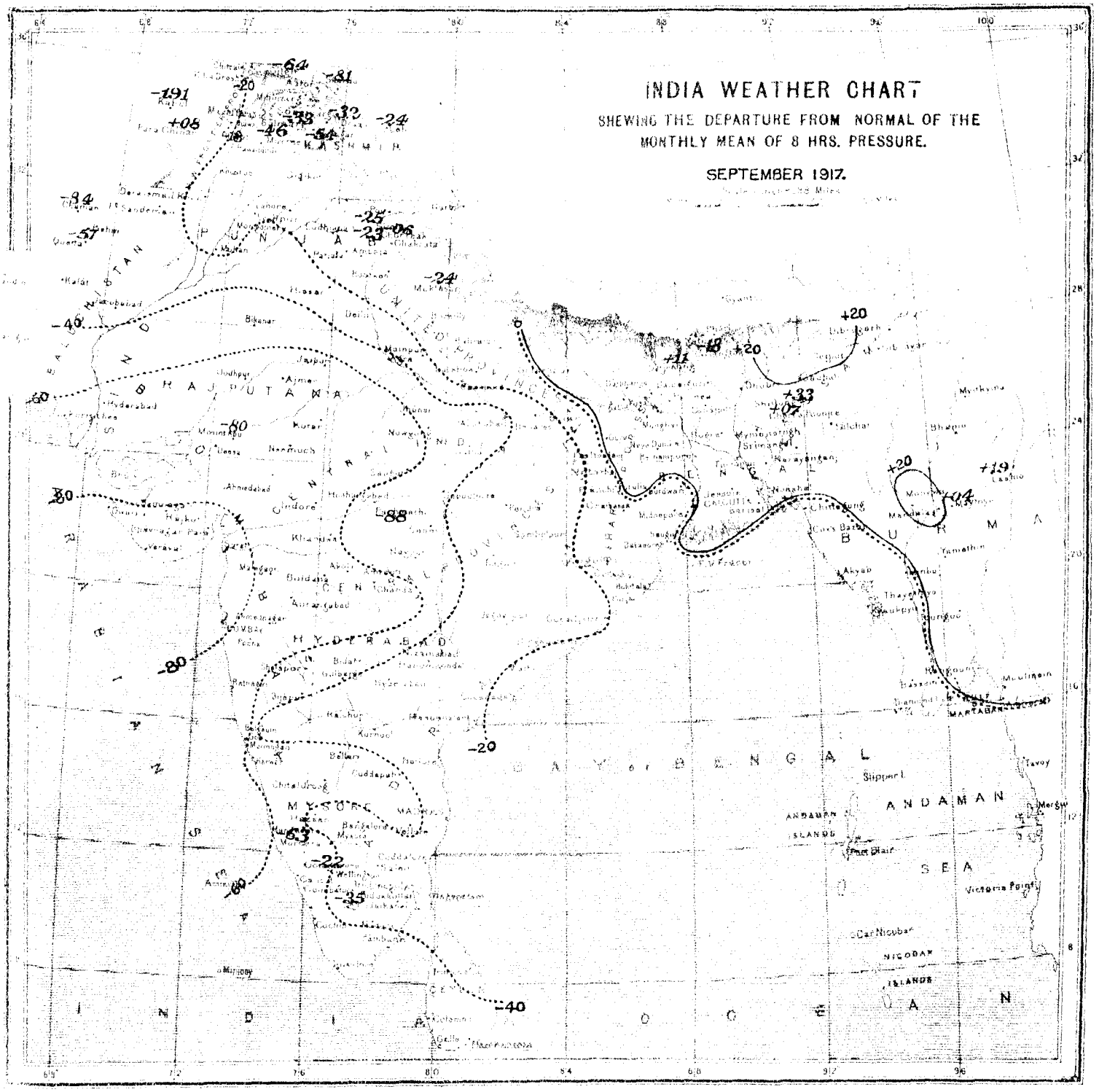


The lines of the above chart represent isobars or lines of equal barometric pressure, the numbers attached indicating the barometric pressure in inches and being drawn for differences of pressure of ·05 inch. The isobars in the Bay of Bengal are filled in by means of the shore observations, and by comparison with the normal distribution of pressure.

The mean 8 hrs. wind directions of the month are shewn by means of arrows flying with the wind, and are calculated by means of Lambert's formula applied to the winds as given in Table B of the 8 hrs. observations. The mean wind directions for the hill stations are indicated by broken arrows to distinguish them from the wind arrows for the plain stations. The mean velocity of the winds during the month is shewn by the following notation:—

Velocity of	0 to 2 miles per hour	...	one feather added to the wind arrow.
,, ,,	2 to 5 ,, ,, ,,	...	two feathers ,, ,, ,, ,,
,, ,,	5 to 10 ,, ,, ,,	...	three ,, ,, ,, ,, ,,
,, ,,	10 to 20 ,, ,, ,,	...	four ,, ,, ,, ,, ,,
	over 20 ,, ,, ,,	...	five ,, ,, ,, ,, ,,

Wind strengths are based on factor 2·2 for the standard type of Beckley Robinson anemograph, instead of 3·0 as used for this plate up to December 1911 inclusive.



The chart shows the departure from normal of the mean during the month of 8 hrs. pressure by means of lines drawn for equal amounts of departure. The numbers are given in thousandths of an inch, 20 representing '020' or two hundredths of an inch, &c. Continuous lines indicate that the pressure was in excess by amounts indicated by the numbers attached to the lines, and broken or dotted lines that it was in defect by amounts indicated by the numbers attached to the lines. Two parallel lines near to each other, one continuous and the other broken or dotted, represent the line of no departure, the dotted line facing the area of deficient pressure or negative departures.

CHART SHEWING THE DEPARTURE FROM NORMAL
OF THE MONTHLY MEAN OF DAILY
MAXIMUM TEMPERATURE.

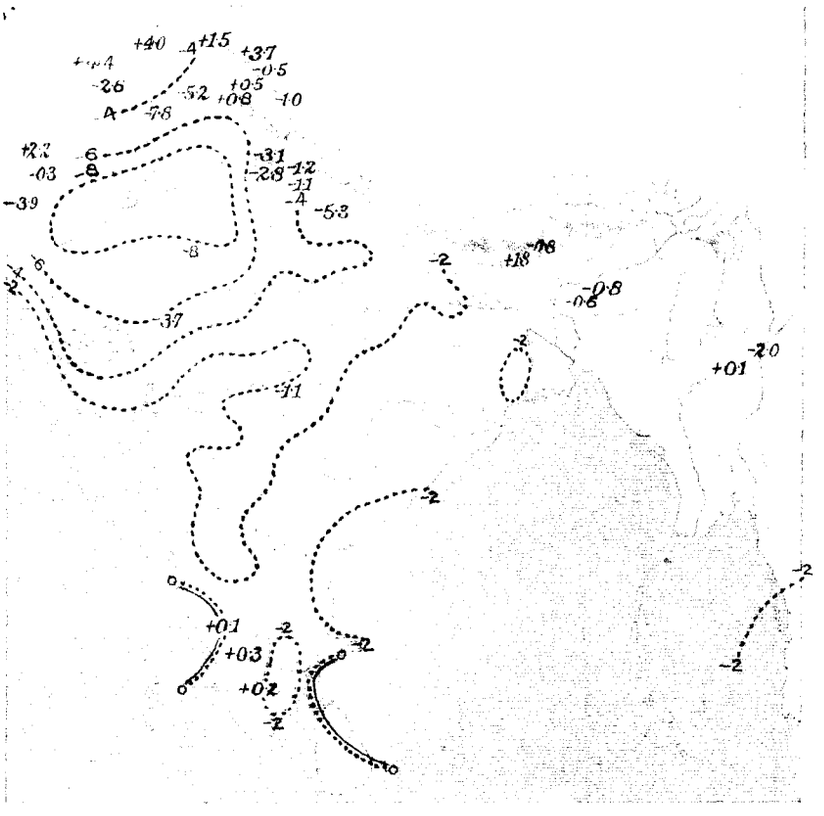


CHART SHEWING THE DEPARTURE FROM NORMAL
OF THE MONTHLY MEAN OF DAILY
MINIMUM TEMPERATURE.

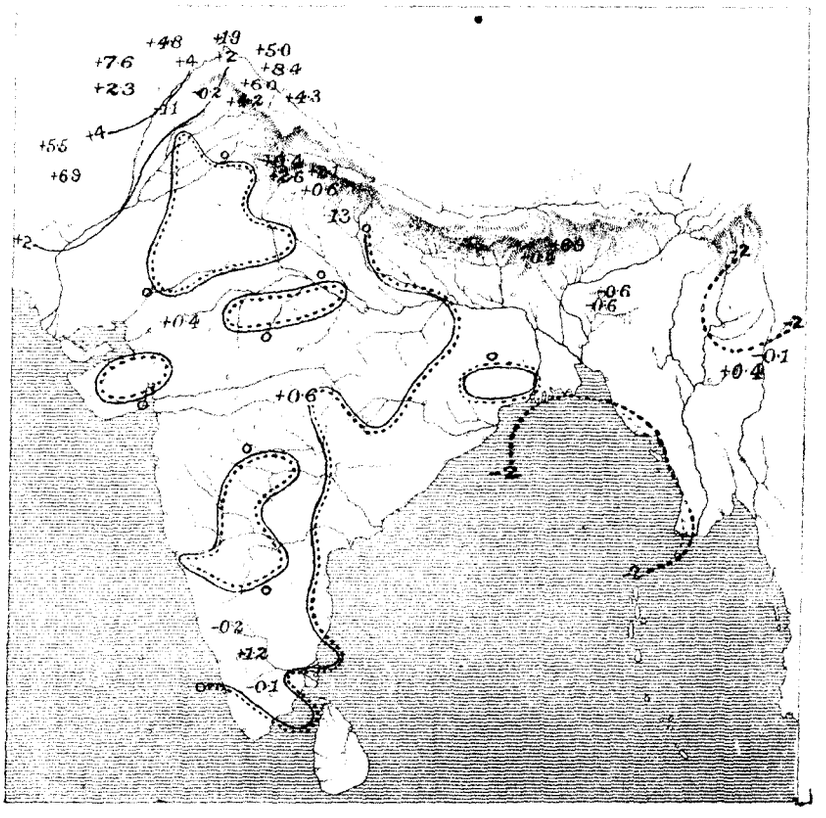


CHART SHEWING THE DEPARTURE FROM NORMAL
OF THE MONTHLY MEAN OF DAILY
MEAN TEMPERATURE.

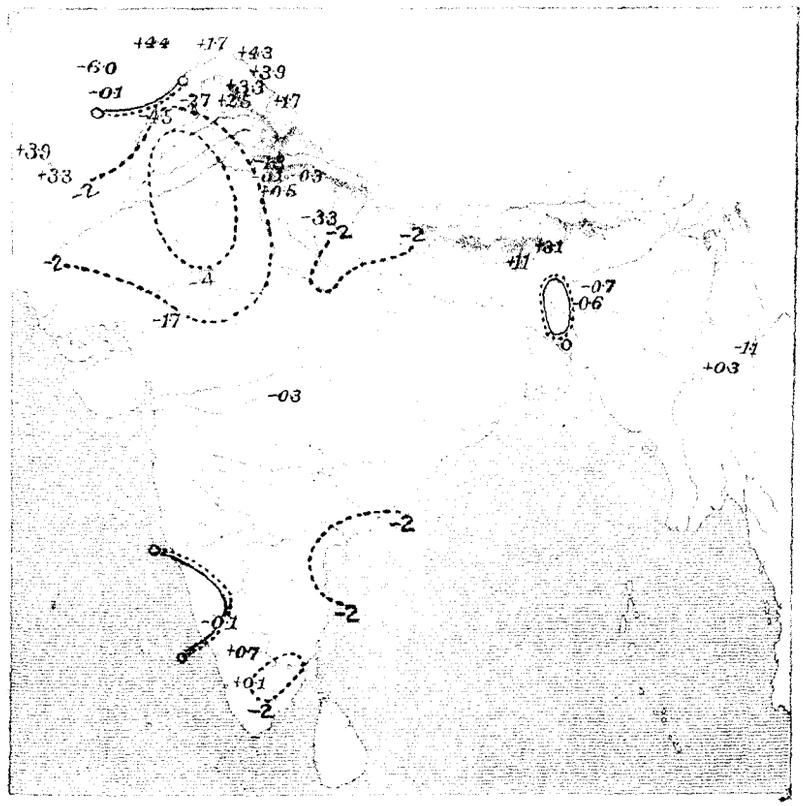


CHART SHEWING THE DEPARTURE FROM NORMAL
OF THE MONTHLY MEAN OF ABSOLUTE
HUMIDITY AT 8 HRS.

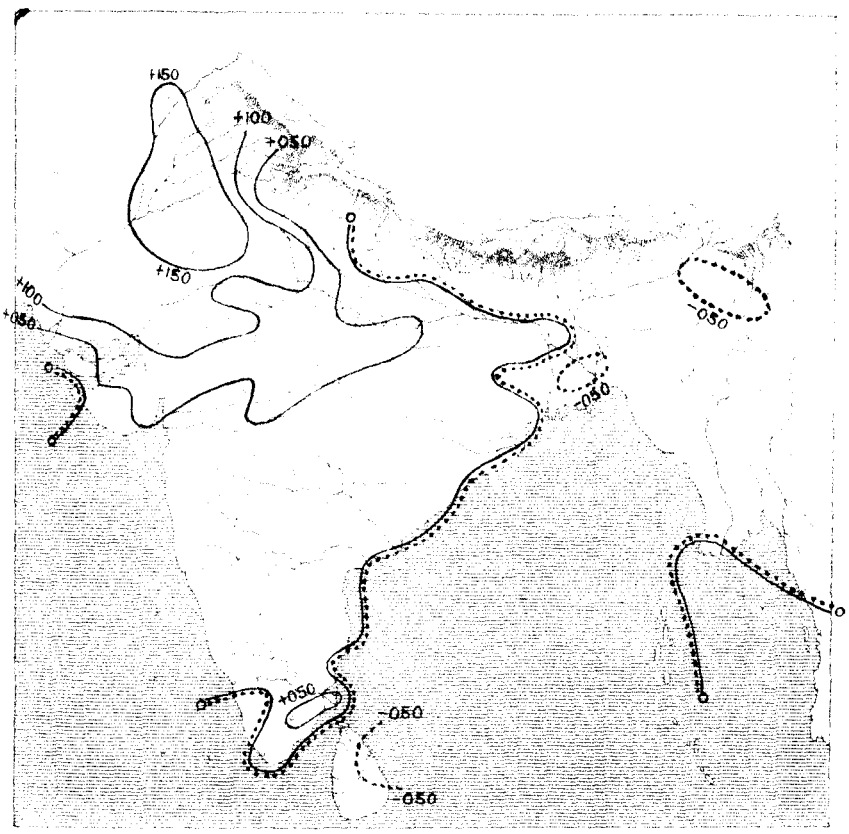


CHART SHEWING THE DEPARTURE FROM NORMAL
OF THE MONTHLY MEAN OF RELATIVE
HUMIDITY AT 8 HRS.

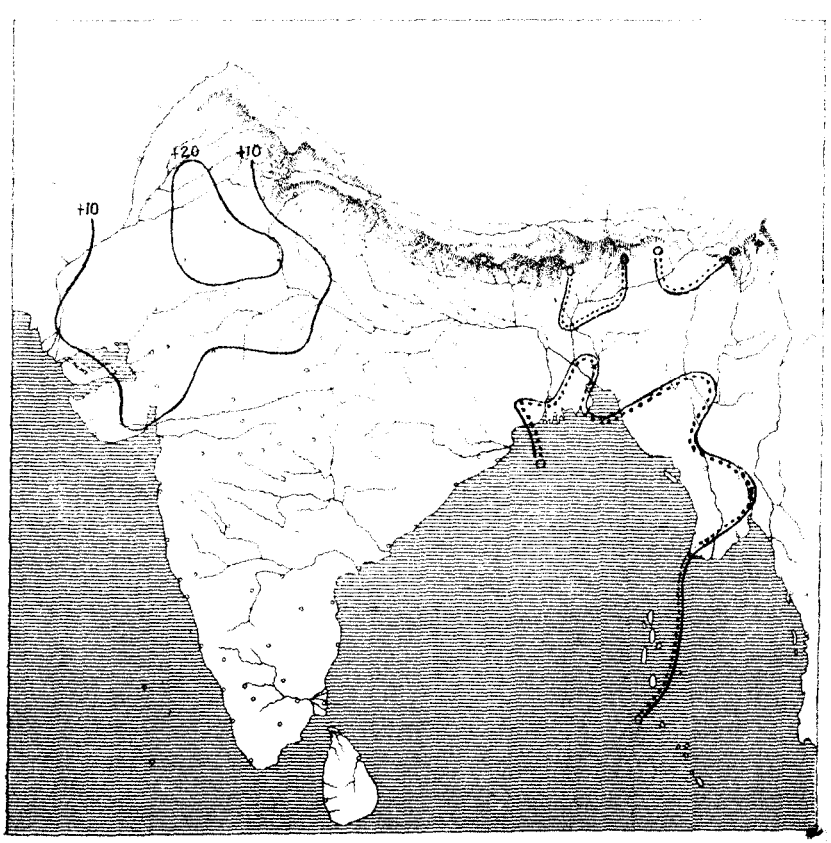


CHART SHEWING THE DEPARTURE FROM NORMAL OF THE MONTHLY MEAN OF CLOUD AMOUNT AT 8 HRS.

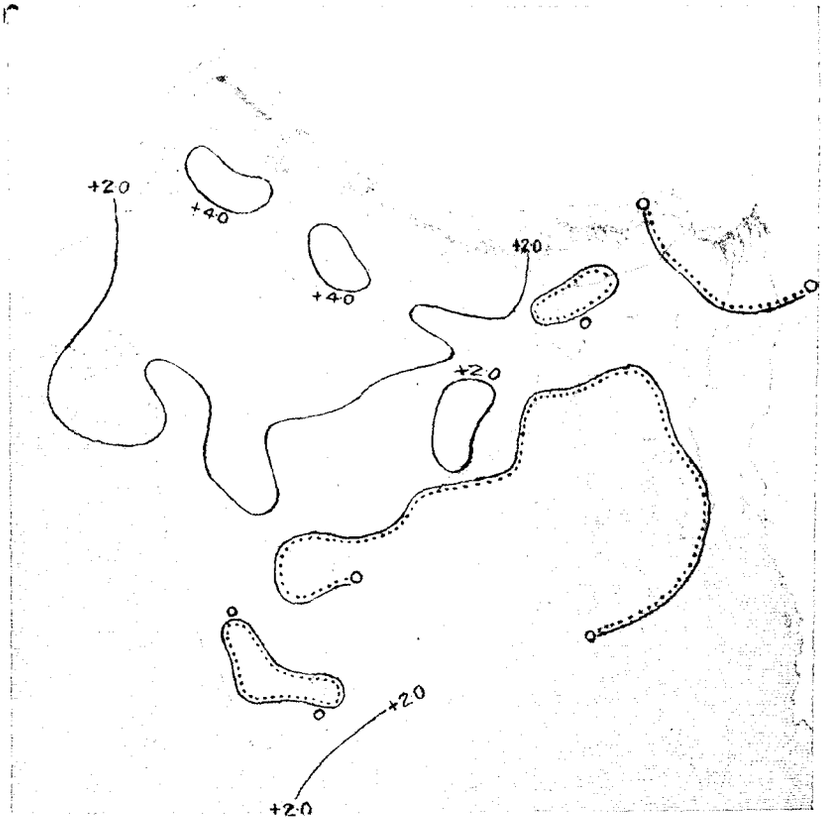
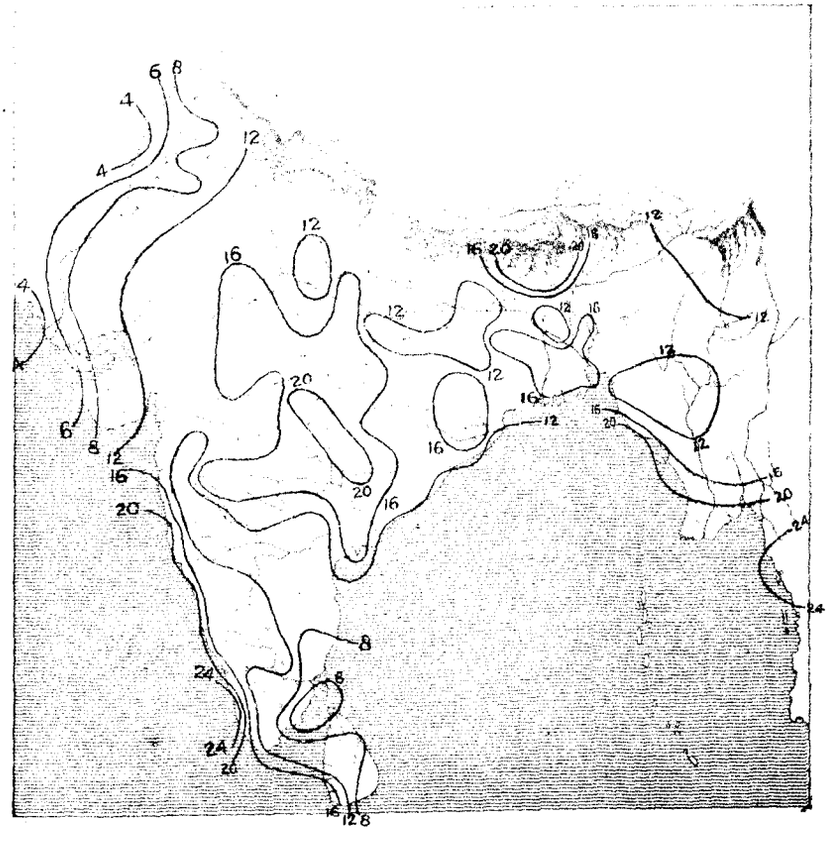
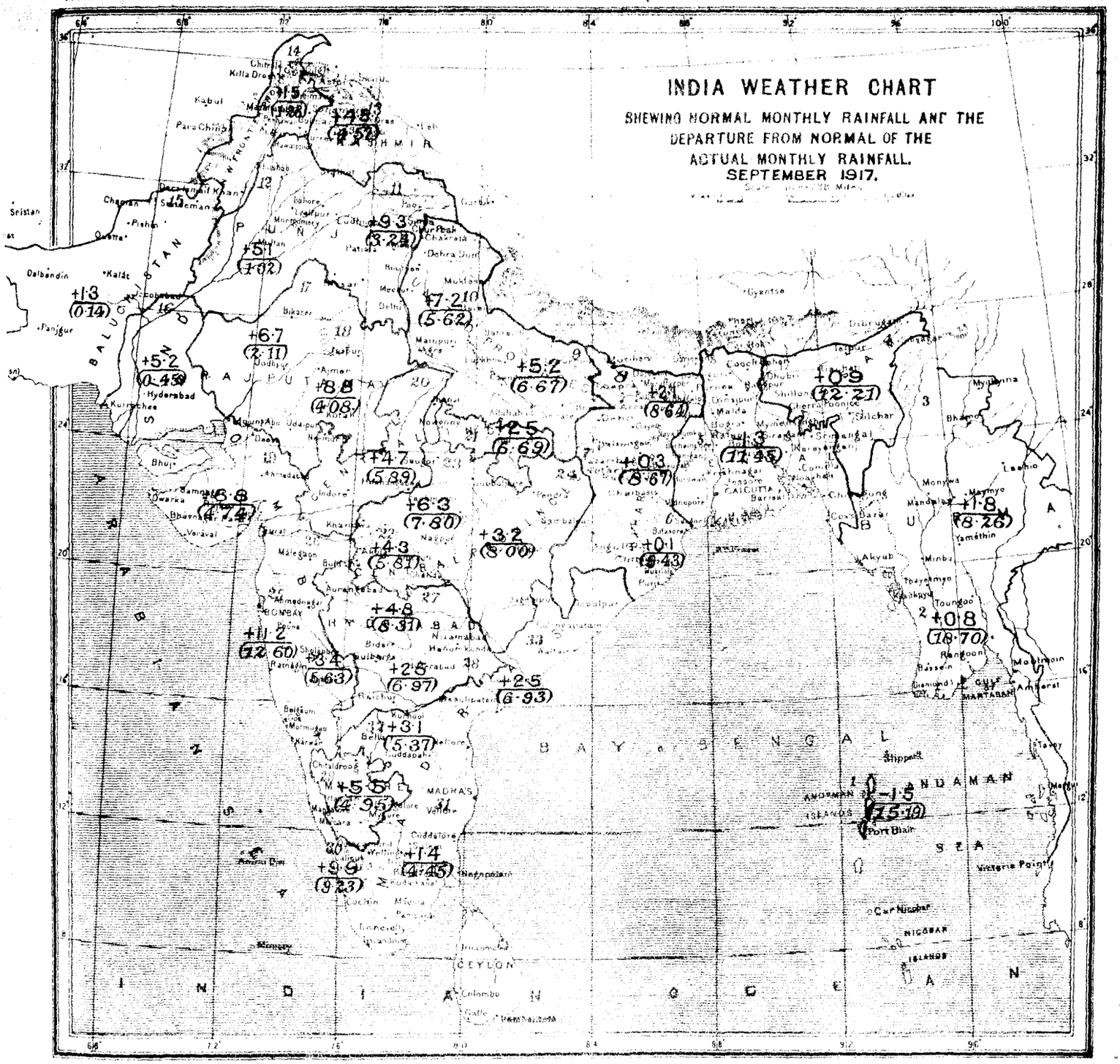


CHART SHEWING THE TOTAL NUMBER OF DAYS IN THE MONTH ON WHICH RAINFALL EQUALLED OR EXCEEDED 0·10 INCH.

(BASED ON THE RETURNS OF TABLE B.)





The country is divided into 33 areas as shewn in the list below. The numbers in that list correspond with the red numbers on the chart, and serve to identify the areas. The numbers in brackets on the chart give the average over the divisions of the normal monthly rainfall, the numbers above these give the departures from normal of the average actual rainfall over the divisions.

1. Bay Islands
2. Lower Burma
3. Upper Burma
4. Assam
5. Bengal
6. Orissa
7. Chota Nagpur
8. Bihar
9. United Provinces, East
10. United Provinces, West
11. Punjab, East and North
12. Do., Southwest
13. Kashmir
14. Northwest Frontier Province
15. Baluchistan
16. Sind
17. Rajputana, West
18. Rajputana, East
19. Gujarat
20. Central India, West
21. Do., East
22. Berar
23. Central Provinces, West
24. Do., East
25. Konkan
26. Bombay, Deccan
27. Hyderabad, North
28. Hyderabad, South
29. Mysore
30. Malabar
31. Madras, Southeast
32. Madras, Deccan
33. Madras Coast, North

GOVERNMENT OF INDIA.

METEOROLOGICAL DEPARTMENT.

MONTHLY WEATHER REVIEW

PUBLISHED BY ORDER OF

THE GOVERNMENT OF INDIA.

CALCUTTA, OCTOBER, 1917.

INTRODUCTION.

THIS review of the weather in India during the month of October, 1917, is based on observations taken daily at 8 hrs. at 218 stations, and on additional observations taken at 10 hrs. and 16 hrs. at 12 stations. In the rainfall summary the data furnished by the meteorological observatories, and such rainfall statements of the month as had been published by the Provincial Governments up to the date of the preparation of the review, have been utilized.

The brief notes on solar, magnetic and seismic disturbances are supplied by the chief observatories.

For a statement of the methods adopted in recording and tabulating the data, for each of the elements of observation, reference should be made to the introductory portion of the review for January.

Summary of the chief features of the weather in India during the month.

2. The month was remarkably wet over by far the greater part of the country. Indeed the Bay Islands and Madras Southeast were the only areas which received appreciably less than the normal quantity of rain. Rainfall was exceptionally heavy for the time of year in the Punjab East and North, Sind, Rajputana West and Gujarat, where it was upwards of fifteen times the normal amount. It was very heavy also in Bengal, Bihar and Orissa, the United Provinces West, Kashmir, Rajputana East, Central India, the Central Provinces, the Konkan and the Bombay Deccan.

In the area consisting of Baluchistan, the North-West Frontier Province and the Punjab South-west the weather was drier even than usual.

As usually happens during periods of abundant rainfall, the air was damper and the sky more cloudy than usual in most parts of the country. Temperature was appreciably low in the Punjab, Rajputana, Bombay and Mysore, and nearly normal in all other divisions.

Barometric pressure in the plains of India as a whole was in defect by ·069″.

Solar, magnetic and seismic disturbances.

KODAIKANAL OBSERVATORY.

3. *Solar Observations.*—No solar observations could be made on 4 days during the month and prominences could not be recorded on 5 days.

Sunspots.—Twenty-eight new groups of spots were observed as against thirty-seven in September. The daily average number was 4·9 and the average life of a spot 5·1 days, the averages for the preceding month being 7·6 and 5·4 respectively. The distribution of the spots in latitude was as follows:—

TABLE 1.

—	0°—10°	11°—20°	21°—30°	Mean latitude.	Extreme latitudes.
North . . .	4	7	2	13°·9	3° and 26°
South . . .	1	10	4	17°·3	°and 2[illegible]

Prominences.—Eighty-nine large and one metallic prominences were recorded during the month. The highest was 210″ and was observed on the 23rd at latitude +70° E.

Magnetic disturbances.—There was one "great" disturbance from the 13th to the 14th and moderate disturbances from the 1st to the 6th, 8th to 11th, 24th to 25th and 28th to 31st.

J. EVERSHED,
Director,
Kodaikanal and Madras Observatories

Seismic records.

$\phi = 10° 13' 50''$ N; $\lambda = 77° 28' 00''$ E; $h = 2{,}343$ m. Subsoil Rock.

Apparatus.—Milne's Horizontal Pendulum Seismograph.

TABLE 2.

	V	To	ϵ	$\frac{r}{To^2}$
AN:				
AE:		18·0		2·6
AZ:				

Date.	Phase.	Time G. M. T.	Period (Sec.).	Amplitude (u). An.	Ae.	Az.	Distance Δ (Km.).	Remarks.
1917.		h. m. s.						
Oct. 17th	e P	1 37 12	...	...	...	...	...	Widening of line.
	F	1 44 18	...	...	...	...	...	
„ 19th	e P	18 12 54	...	...	...	...	...	Widening of line.
	F	18 23 06	...	...	...	...	...	
„ 22nd	e L	8 53 18	...	...	...	...	...	
	M	8 56 36	...	...	50	...	...	
	F	9 02 30	...	...	...	...	...	
„ 29th	e P	21 34 06	...	...	...	...	...	Widening of line.
	F	21 38 36	...	...	...	...	...	

J. EVERSHED,
Director,
Kodaikanal and Madras Observatories.

BOMBAY OBSERVATORY.

Alibag magnetic record.

4. During the month of October, 1917, the traces showed 12 calm days, and 19 days of small disturbance.

The days of the month selected as "quiet" for the purposes of the Magnetic Survey of India are the 7th, 10th, 16th, 21st and 22nd.

The following table represents the magnetic character of each day during the month :—

TABLE 3.

Day.	Character.	Day.	Character.	Day.	Character.	Day.	Character.
1	S	9	S	17	C	25	S
2	S	10	C	18	C	26	C
3	S	11	S	19	C	27	S
4	S	12	C	20	C	28	S
5	S	13	S	21	C	29	S
6	S	14	S	22	C	30	S
7	C	15	C	23	S	31	S
8	S	16	C	24	S		

C=calm; S=small; M=moderate; G=great; V. G.=very great.

The mean observed absolute values of the several magnetic elements reduced to the mean monthly tabulations of the magnetograms, as also the ranges and the summed ranges of the horizontal force and the declination for the month are as follows :—

Easterly declination	0° 31′ 6″.
Horizontal force	0·36877 C.G.S. unit.
Vertical force	0·16900 C.G.S. „
Inclination	24° 37′·2.
Horizontal force range	0·00062 C.G.S. unit.
„ „ summed range	0·00389 C.G.S. „
Declination range	2′·8.
„ summed range	10′·3.

(NOTE.—Summed range means sum without regard to sign of the twenty-four ordinates of the diurnal inequality.)

Seismic records.

$\phi = 18° 53' 36''$ N; $\lambda = 72° 48' 56''$ E; $h = 11$ m. Subsoil Trap.

Apparatus.—Milne's Horizontal Pendulum Seismograph.

TABLE 4.

	V	To	ϵ	$\frac{r}{To^2}$
AN:				
AE:	9	19	1	
AZ:				

Date.	Phase.	Time G. M. T.	Period (Sec.).	Amplitude (u). An.	Ae.	Az.	Distance Δ (Km.).	Remarks.
1917.		h. m. s.						
Oct. 16th	...	17 40 0	...	...	...	...	...	Thickening of line.
„ 17th	P	*1 30 12	...	...	...	...	...	P mixed in tremors.
	M	1 33 56	...	...	56	...	...	
	F	.....	...	...	...	...	...	F mixed in tremors.
		m m						
„ 19th	...	18 7 to 12	...	...	...	...	...	Thickening of line.
„ 21st	...	7 44 to 47	...	...	...	...	...	Ditto.
„ 22nd	...	8 49 to 56	...	...	...	...	...	Ditto.

Sensibility to tilt 1·0 mm. of amplitude on the trace = 0·32".

* This time is as shown by the float record (Tilt Seismograph).

N. A. F. Moos,
Director,
Bombay and Alibag Observatories.

5.—CALCUTTA (ALIPORE) OBSERVATORY.

Seismic records.

No seismic displacement was recorded on the Calcutta seismograph during the month.

6.—SIMLA OBSERVATORY.

Seismic records.

$\phi = 31° 6' N$; $\lambda = 77° 11' E$; $h = 2433·5$ m. Subsoil Rock.

Apparatus.—Two Omori-Ewing Horizontal Pendulum Seismographs (Masses 50 kg.).

TABLE 5.

	V	To	ϵ	$\frac{r}{To^2}$
AN:	14	45	1	
AE:	14	45	1	
AZ:				

Date.	Phase.	Time G. M. T.	Period (Sec.).	Amplitude (u). An.	Ae.	Az.	Distance Δ (Km.).	Remarks.
1917.		h. m. s.						
Oct. 4th	e P	12 12 30	...	...	...	...	...	
	S	12 17 54	...	...	...	...	...	
	L	12 21 54	...	...	...	...	...	
	M	12 26 24	40	429	...	...	...	
	F	13 26 54	...	...	...	...	...	
„ 17th	e	1 28 18	...	...		...	...	
	M	1 30 54	...	..	71	...	...	
	F	1 39 54	...	..	...	...	...	

The following table contains a list of earthquakes that were reported :—

TABLE 6.

Place at which felt.	Date.	G. M. T. of earthquake.	Duration.	Intensity Rossi-Forel scale.	No. of shocks.	Remarks.
		h. m.	sec.			
Chaman . .	Oct. 17th	1 17	10	7	4	
Pishin . . .	„ 17th	2 43	17	4	2	
Shillong . .	„ 20th	3 32	3	5	1	
Chaman . .	„ 21st	16 35	4	4	2	
Drosh . . .	„ 29th	5 30	8	7	2	

Solar radiation.—Observations were not recorded owing to absence of officers on war service.

C. W. B. NORMAND,
Imperial Meteorologist, Simla.

Weather in the Indian Ocean.

7. The low pressure conditions prevailing over India did not extend to the stations in the Indian Ocean where pressure was normal. Winds were strong but sensibly normal in direction at Mauritius and Seychelles, while at Zanzibar they were weaker and more easterly than usual. Rainfall was above normal at Mauritius, but below it at the equatorial stations.

TABLE 7.

	Mauritius.	Zanzibar.	Seychelles.
Departure from normal of mean pressure	—·001	+·002	+·005
Actual mean wind direction . .	S 60° E	S 1° E	S 34° E
Normal mean wind direction . .	S 76° E	S 20° E	S 39° E
Actual mean wind velocity (miles per diem).	228	62	176
Normal mean wind velocity (miles per diem).	190	89	139
Rainfall departure from normal . .	+5·06	—1·40	—4·33

Depressions and cyclonic storms.

8. A depression which formed about 250 miles off the south Arakan coast on the 29th and 30th September began to move in a westnorthwesterly direction on the 30th. This depression lay over the Orissa coast from the 1st to the 3rd October. The centre appeared to cross the coast on the night of the 1st but was definitely over the sea again at 8 A.M. on the 3rd. It crossed the coast finally about midnight and then followed a curved path passing in the neighbourhood of Sambalpore, Ranchi and Naya Dumka and disappeared in south Assam on the 9th; it caused widespread heavy rain along its track.

Weather was somewhat disturbed off the Coromandel coast during the third week; the disturbance did not develop into a well-marked depression but caused some heavy falls of rain from Madras to Masulipatam between the 18th and 21st.

An area of disturbed weather, which lay off the north Malabar coast on the 18th and 19th, formed into a shallow depression and began to move in a northwesterly direction on the latter date. By the morning of the 24th it had reached a position roughly 300 miles west of Bombay; from there it curved in a northeasterly direction, crossed the Kathiawar coast between Dwarka and Veraval on the 25th, and having given general rain along its track in Gujarat, Rajputana and the Punjab broke up in the east Punjab hills on the night of the 26th. Information from ships is insufficient to allow the severity of the storm to be determined while it was over the sea; while passing inland it was a moderately severe storm with a barometric depth of over 0·42″. *S. S. Haim*, which was off the Kathiawar coast on the 24th and the 25th, recorded winds of force 8 to 9 on those days.

A depression which formed about 150 miles to the west of the Andamans on the 25th moved in a northwesterly direction till it reached to within 100 miles of Gopalpur on the 29th; from there it curved to the northeast and having given widespread rain in northeast India on the 29th and 30th disappeared in Assam during that day. The greatest barometric depth observed was over 0·4″, and the strongest winds recorded on board ships were of force 6.

A disturbance of the cold weather type affected the weather in northwest India during the fourth week of the month.

Pressure.

9. Barometric pressure was below the normal throughout the plains by amounts ranging from about 0·03″ in Malabar to about a tenth of an inch in the tract from south Gujarat to the Orissa coast. On the mean of all the plains observatories there was a defect of ·069″ which has been exceeded only on five occasions since 1876.

The statement below giving the most noteworthy deficiencies recorded in previous years shows the extraordinary character of the pressure conditions prevailing in the month under review:—

TABLE 8.

Month and Year.	Departure from normal of mean pressure over the Indian plains.
	″
January 1887	—·071
March 1892	—·076
February 1898	—·077
October 1915	—·074
June 1916	—·078

The deficiency was almost as marked at the level of most of the hill stations as in the adjacent plains, an indication that it was due to some cause affecting the upper atmosphere.

TABLE 9.

DIVISION.	Departure from normal of mean 8 hrs. pressure.
	"
Burma	—·045
Assam	—·055
Bengal	—·081
Bihar and Orissa	—·088
United Provinces	—·063
Punjab	—·053
North-West Frontier Province	—·055
Siud	—·059
Rajputana	—·064
Bombay	—·088
Central India	—·081
Central Provinces	—·096
Hyderabad	—·073
Mysore	—·054
Madras	—·057

TABLE 10.

HILL STATION.	Departure from normal pressure. A.	PLAIN STATION.	Departure from normal pressure. B.	Departure of pressure difference B—A.
	"		"	"
Quetta	—·056	Jacobabad	—·048	+·008
Leh	—·049	Lahore	—·051	—·002
Murree	—·088	Peshawar	—·062	+·026
Simla	—·065	Ludhiana	—·049	+·016
Mukteswar	—·065	Bareilly	—·060	+·005
Darjiling	—·043	Dhubri	—·063	—·020
Mount Abu	—·095	Deesa	—·084	+·011
Pachmarhi	—·112	Khandwa	—·094	+·018
Kodaikanal	—·051	Madura	—·048	+·003

Temperature.

10. Maximum temperature was between 4° and 9° below normal in the Bombay Deccan, north and east Gujarat, Central India West, Rajputana, the Punjab and the adjoining districts of the United Provinces and was about the average elsewhere. Minimum temperature was sensibly normal in almost all parts of the country with the exception of Chota Nagpur, Central India East and the Central Provinces, where it was about 4° higher than usual.

TABLE 11.

SUB-DIVISION.	ACTUAL TEMPERATURE.				DEPARTURE FROM NORMAL OF		
	Mean maximum.	Mean minimum.	Monthly mean of mean between maximum and minimum.	Mean daily range of temperature.	Maximum.	Minimum.	Daily range.
	°	°	°	°	°	°	°
1. Bay Islands	84·3	76·5	80·5	7·9	—1·7	—0·7	—1·0
2. Lower Burma	85·8	74·6	80·3	11·2	—1·4	—0·7	—0·7
3. Upper Burma	88·0	72·3	80·2	15·7	—0·7	+0·4	—1·1
4. Assam	86·0	71·6	78·9	14·3	—0·9	+0·7	—1·6
5. Bengal	86·8	74·9	80·8	12·0	—0·8	+1·2	—2·0
6. Orissa	86·8	75·9	81·3	10·9	—2·3	+2·5	—4·8
7. Chota Nagpur	85·5	71·8	78·7	13·7	—2·0	+3·8	—5·8

SUB-DIVISION.	ACTUAL TEMPERATURE.				DEPARTURE FROM NORMAL OF		
	Mean maximum.	Mean minimum.	Monthly mean of mean between maximum and minimum.	Mean daily range of temperature.	Maximum.	Minimum.	Daily range.
	°	°	°	°	°	°	°
8. Bihar	86·3	73·4	79·8	13·0	-2·6	+2·6	—5·2
9. United Provinces, East	88·3	70·7	79·5	17·7	—2·0	+3·1	—5·1
10. Do. do., West	86·8	67·3	77·0	19·5	—4·8	+1·4	—6·2
11. Punjab, East and North	85·3	63·3	74·3	22·1	—6·8	+0·8	—7·6
12. Do., South-west	89·7	64·0	76·9	25·7	—5·4	+0·6	—6·0
13. Kashmir	65·9	41·5	53·7	24·4	—1·7	+0·9	—2·6
14. North-West Frontier Province	88·6	60·5	74·5	28·1	—2·4	+1·0	—3·4
15. Baluchistan	81·1	48·5	64·8	32·6	—2·5	—2·8	+0·3
16. Sind	93·3	68·3	80·8	25·0	—1·2	—0·5	—0·7
17. Rajputana, West	89·3	67·8	78·5	21·5	—7·1	—1·7	—5·4
18. Do., East	85·6	65·5	75·5	20·1	—8·3	—1·0	—7·3
19. Gujarat	88·2	71·3	79·8	16·9	—5·8	+0·4	—6·2
20. Central India, West	83·9	65·7	74·8	18·3	—5·9	+1·8	—7·7
21. Do. do., East	85·9	68·9	77·4	16·9	—3·1	+3·5	—6·6
22. Berar	85·5	69·7	77·6	15·8	—4·1	+3·6	—7·7
23. Central Provinces, West	85·7	69·1	77·4	16·7	—3·3	+3·4	—6·7
24. Do. do., East	84·9	70·5	77·7	14·4	—2·0	+3·9	—5·9
25. Konkan	83·5	73·9	78·7	9·5	—3·4	—0·6	—2·8
26. Bombay Deccan	82·8	67·5	75·1	15·4	—5·8	+0·9	—6·7
27. Hyderabad, North	84·7	68·9	76·8	15·8	—6·4	+2·1	—8·5
28. Do., South	86·8	72·1	79·5	14·7	—3·4	+2·3	—5·7
29. Mysore	80·0	64·7	72·3	15·3	—3·2	—1·3	—1·9
30. Malabar	83·3	73·6	78·5	9·8	—1·9	—1·0	—0·9
31. Madras, South-east	89·1	73·8	81·5	15·2	—0·7	—0·5	—0·2
32. Do. Deccan	87·8	72·6	80·2	15·1	—3·5	+0·5	—4·0
33. Do. Coast, North	87·0	76·5	81·7	10·5	—1·9	+0·7	—2·6

TABLE 12.

DIVISION.	DEPARTURE FROM NORMAL OF		
	Mean maximum temperature.	Mean minimum temperature.	Mean temperature.
	°	°	°
Burma	—1·1	—0·2	—0·6
Assam	—0·9	+0·7	—0·1
Bengal	—0·8	+1·2	+0·2
Bihar and Orissa	—2·3	+2·9	+0·3
United Provinces	—3·3	+2·4	—0·5
Punjab	—6·4	+0·7	—2·9
North-West Frontier Province	—2·4	+1·0	—0·7

DIVISION.	DEPARTURE FROM NORMAL OF		
	Mean maximum temperature.	Mean minimum temperature.	Mean temperature.
	°	°	°
Sind	—1·2	—0·5	—0·9
Rajputana	—7·8	—1·2	—4·5
Bombay	—5·4	+0·4	—2·5
Central India	—4·5	+2·7	—0·9
Central Provinces	—3·1	+3·6	+0·2
Hyderabad	—4·1	+2·3	—0·9
Mysore	—3·2	—1·3	—2·3
Madras	—1·7	—0·2	—0·9

Winds.

11. (*a*) The air movement was appreciably stronger than usual in Burma, northeast India, and the Peninsula, and was lighter than usual in the North-West Frontier Province, Sind and Rajputana.

(*b*) The degree of steadiness was high in Assam, Bengal, the Punjab, Sind, the Central Provinces, Hyderabad, Mysore and Madras, and low in the United Provinces, the North-West Frontier Province, Rajputana, Bombay and Central India.

(*c*) The direction of air movement varied a good deal from the normal in places.

TABLE 13.

DIVISION.	DEPARTURE FROM NORMAL OF	
	Hourly wind velocity.	Wind steadiness.
Burma	+0·5	+ 2
Assam	+0·7	+27
Bengal	+0·3	+ 9
Bihar and Orissa	+0·6	+ 2
United Provinces	—0·1	— 5
Punjab	+0·1	+ 5
North-West Frontier Province	—0·7	—15
Sind	—2·7	+ 7
Rajputana	—0·5	—22
Bombay	+0·7	—7
Central India	—0·3	—10
Central Provinces	+0·8	+ 7
Hyderabad	+0·9	+ 4
Mysore	+1·6	+33
Madras	+0·9	+11

Humidity and cloud.

12. Humidity conditions were nearly normal in upper Sind, west Gujarat, north Bihar, Bengal, Assam, Burma and the southern half of the Peninsula; but elsewhere in the plains the air was generally much damper than usual, both relatively and absolutely.

Cloud amount was about the average or in defect in northeast Baluchistan, Kashmir, the Indus Valley and at some stations in Assam, Mysore and south Malabar, and in excess in nearly all other places. The excess was most marked in Bihar and Orssia, Bombay, Central India, the Central Provinces and Hyderabad.

TABLE 14.

DIVISION.	HYGROMETRY; 8 HRS.				CLOUD.	
	Mean humidity.	Departure from normal.	Mean vapour tension in inches of mercury.	Departure from normal in inches of mercury.	Mean cloud amount at 8 hrs.	Departure from normal.
	%					
Burma	89	+ 1	·847	—·011	6·5	+1·3
Assam	89	— 1	·794	+·001	5·0	+0·2
Bengal	87	+ 2	·870	+·024	4·4	+0·9
Bihar and Orissa	87	+ 8	·828	+·095	5·6	+2·8
United Provinces	77	+ 7	·690	+·099	2·2	+1·2
Punjab	74	+18	·566	+·120	1·1	+0·6
North-West Frontier Province.	71	+12	·502	+·081	0·3	—0·5
Sind	61	— 1	·559	—·025	0·6	—0·2
Rajputana	68	+18	·562	+·093	2·4	+1·4
Bombay	80	+10	·716	+·038	5·7	+3·0
Central India	77	+15	·647	+·109	4·5	+2·7
Central Provinces	78	+12	·684	+·114	5·2	+2·5
Hyderabad	79	+12	·700	+·061	6·6	+3·3
Mysore	85	+ 4	·610	—·030	6·5	+0·1
Madras	81	0	·796	—·019	5·7	+0·5

Rainfall.

13. The monsoon was remarkably vigorous and produced unusually heavy rain over a large part of the country. Three storms appeared over the Bay and one over the Arabian Sea. Of the Bay storms two travelled into northeast India causing heavy downpours of rain along their track, and one broke up near Nellore while travelling north along the Coromandel coast. The Arabian Sea storm crossed into Kathiawar at about noon on the 25th, and after travelling rapidly in a northeasterly direction was dissipated in the hills of the east Punjab on the night of the 26th. It was fairly severe and occasioned a burst of heavy and unseasonable rainfall over the area traversed by it. In addition a cold weather disturbance affected the extreme north during the last week and gave rise to appreciable snowfall in the western Himalayas, besides stimulating the activity of the storm from the Arabian Sea.

The rainfall of the month was unusually heavy for the time of year in Bengal, Bihar and Orissa, the United Provinces West, the Punjab East and North, Kashmir, Rajputana, Gujarat, Central India, the Central Provinces including Berar, the Konkan and the Bombay Deccan, the amounts received being two to sixteen times the normal, while in Sind, where ordinarily no rain falls, during the time, the month's fall was 1¼″. It was upwards of 30 per cent. in excess also in Burma, Assam, Hyderabad, Malabar, the Madras Deccan and the Madras Coast North. Over the rest of the country the fall was either about the normal or below it, the defect being as much as 2½″ in Madras South-east and 2″ in the Bay Islands.

The mean rainfall over the plains as a whole was 6·1″, more than double the normal amount; this is the largest excess recorded in October since 1875.

TABLE 15.

SUB-DIVISION.	NUMBER OF RAINY DAYS.		RAINFALL.			
	Actual.	Normal.	Actual.	Normal.	Departure from normal.	Percentage departure from normal.
			″	″	″	
1. Bay Islands	14·5	12·9	6·65	8·71	— 2·06	— 24
2. Lower Burma	15·4	10·4	12·23	7·68	+ 4·55	+ 59
3. Upper Burma	9·6	7·2	7·23	5·41	+ 1·82	+ 34
4. Assam	8·0	6·4	7·15	5·14	+ 2·01	+ 39
5. Bengal	9·1	4·9	13·57	4·50	+ 9·07	+ 202
6. Orissa	13·4	5·1	15·17	4·23	+ 10·94	+ 259
7. Chota Nagpur	10·2	3·0	10·16	2·07	+ 8·09	+ 391
8. Bihar	5·8	2·6	5·61	2·36	+ 3·25	+ 133
9. United Provinces, East	3·2	1·7	2·21	1·99	+ 0·22	+ 11
10. Do. do., West	3·2	0·8	3·57	0·90	+ 2·67	+ 297
11. Punjab, East and North	2·6	0·4	4·02	0·26	+ 3·76	+ 1446
12. Do., South-west	0	0·1	0·01	0·04	— 0·03	— 75
13. Kashmir	3·4	1·2	4·17	0·64	+ 3·53	+ 552
14. North-West Frontier Province	0·5	0·6	0·20	0·26	— 0·06	— 23
15. Baluchistan	0	0·1	0	0·03	— 0·03	— 100
16. Sind	0·5	0	1·24	0·01	+ 1·23	+ 12300
17. Rajputana, West	2·1	0·1	3·08	0·05	+ 3·03	+ 6060
18. Do., East	4·5	0·4	3·54	0·44	+ 3·10	+ 705
19. Gujarat	8·9	0·8	9·54	0·59	+ 8·95	+ 1517
20. Central India, West	4·9	0·8	3·45	0·56	+ 2·89	+ 516
21. Do. do., East	3·6	1·1	2·34	1·02	+ 1·32	+ 129
22. Berar	6·5	2·1	3·58	1·55	+ 2·03	+ 131
23. Central Provinces, West	5·5	1·8	3·13	1·35	+ 1·78	+ 132

Sub-division.	Number of rainy days.		Rainfall.			
	Actual.	Normal.	Actual.	Normal.	Departure from normal.	Percentage departure from normal.
			"	"	"	
24. Central Provinces, East	7·5	2·2	5·60	1·55	+ 4·05	+ 261
25. Konkan	14·8	5·4	16·28	3·97	+ 12·31	+ 310
26. Bombay Deccan	9·2	4·5	6·34	3·06	+ 3·28	+ 107
27. Hyderabad, North	6·5	3·3	3·56	2·43	+ 1·13	+ 47
28. Do, South	8·8	4·2	5·10	2·92	+ 2·18	+ 75
29. Mysore	8·6	7·9	5·88	5·42	+ 0·46	+ 8
30. Malabar	16·1	11·6	13·01	9·88	+ 3·13	+ 32
31. Madras, South-east	6·1	9·1	4·99	7·46	— 2·47	— 33
32. Do. Deccan	7·1	5·9	6·35	4·25	+ 2·10	+ 49
33. Do. Coast, North	11·8	6·7	10·80	6·45	+ 4·35	+ 67

TABLE 16.

Division.	Rainfall.			
	Actual.	Normal.	Departure from normal.	Percentage departure from normal.
	"	"	"	
Burma	9·19	6·30	+ 2·89	+ 46
Assam	7·15	5·14	+ 2·01	+ 39
Bengal	13·57	4·50	+ 9·07	+ 202
Bihar and Orissa	9·17	2·76	+ 6·41	+ 232
United Provinces	2·94	1·40	+ 1·54	+ 110
Punjab	3·03	0·21	+ 2·82	+ 1343
North-West Frontier Province	0·20	0·26	− 0·06	— 23

Division.	Rainfall.			
	Actual.	Normal.	Departure from normal.	Percentage departure from normal.
	"	"	"	
Sind	1·24	0·01	+ 1·23	+ 12300
Rajputana	3·37	0·32	+ 3·05	+ 953
Bombay	9·16	2·43	+ 6·73	+ 277
Central India	2·89	0·79	+ 2·10	+ 266
Central Provinces	4·21	1·49	+ 2·72	+ 183
Hyderabad	4·29	2·66	+ 1·63	+ 61
Mysore	5·88	5·42	+ 0·46	+ 8
Madras	7·61	7·00	+ 0·61	+ 9
Mean of India	6·08	2·86	+ 3·22	+ 113

Snowfall.

I.—AFGHANISTAN.

14. No report has been received.

II.—NORTH-WEST FRONTIER PROVINCE.

Drosh.—Light snow (not more than 6" in depth) fell on the 23rd, 24th and the 28th on the hills surrounding the station.

III.—KASHMIR.

(*a*) *Srinagar.*—Snow fell on the 27th on the ranges to the north-east.

(*b*) *Skardu.*—On the mountains surrounding the station snow occurred on the 6th, 26th to the 28th and the 31st. The fall of the 26th was heavy, more than 3 feet in depth on the higher mountains, and extended down to the level of the station. At the end of the month about 3 feet of snow still lay unmelted on the higher mountains and 4 to 5 inches on the lower.

(*c*) *Dras.*—Snowfall was of daily occurrence during the last six days of the month and amounted altogether to about 5½ feet.

(*d*) *Kargil.*—Snowfall occurred on the neighbouring mountains on the 7th and again daily from the 26th to the 30th. The total fall was estimated at about 10½ feet on the Archulla, 7½ feet on the Nakthulla and Samenulla and 6½ feet on the Barulla ranges and about 6 feet on other mountains.

The statement below shows the estimated depth of the unmelted residue of the accumulations on the last day of the month :—

Archulla	8	feet
Nakthulla	6	,,
Samenulla	5	,,
Narianulla	2½	,,
Pazgolla	2½	,,
Barulla	2½	,,

(*e*) *Leh.*—An exceptionally heavy fall for the time of year occurred on the 26th closing the passes for some time and doing much damage.

IV.—PUNJAB.

(*a*) *Kulu (Kangra.)*—The Rohtang and Hamta passes were completely blocked on account of heavy falls of snow which occurred from the 25th to 28th. Snow fell to about 8,000 feet in upper Kulu. The precipitation on the ranges to the east of Kulu appears to have been somewhat less heavy. The Bavalucha pass was also closed at the end of the month.

(*b*) *Poo.*—Heavy snowfall occurred between the 25th and the 27th.

(*c*) *Kilba (Simla Hills).*—Snow fell on the surrounding hills from the 25th to the 27th and again on the 30th. The lowest level reached was 9,000 feet.

TABLE 17.

Name of pass.	Depth of accumulation at the end of the month.	
	Reported.	Normal.
Rupin	6 feet	3 feet.
Brua	7 ,,	3¾ ,,
Harapg	2 ,,	¼ ,,
Shatul	6 ,,	2¾ ,,

V.—UNITED PROVINCES.

(*a*) *Garhwal.*—Snow is reported to have fallen on the higher elevations in the north of the district.

(*b*) *Almora.*—The total fall of the month was estimated at 14½ feet in Byans, 7½ feet in Malla Darma, 3½ feet in Malla Johar, 3⅜ feet in Chaudas and 2 feet in Malla Danpur. The snowline descended to a distance of 8½ miles below the perpetual snows in Malla Darma, 3 or 4 miles in Malla Danpur, 2 miles in Byans and ½ mile in Malla Johar and Chaudas.

The accumulations at the end of the month were as shown in the following table :—

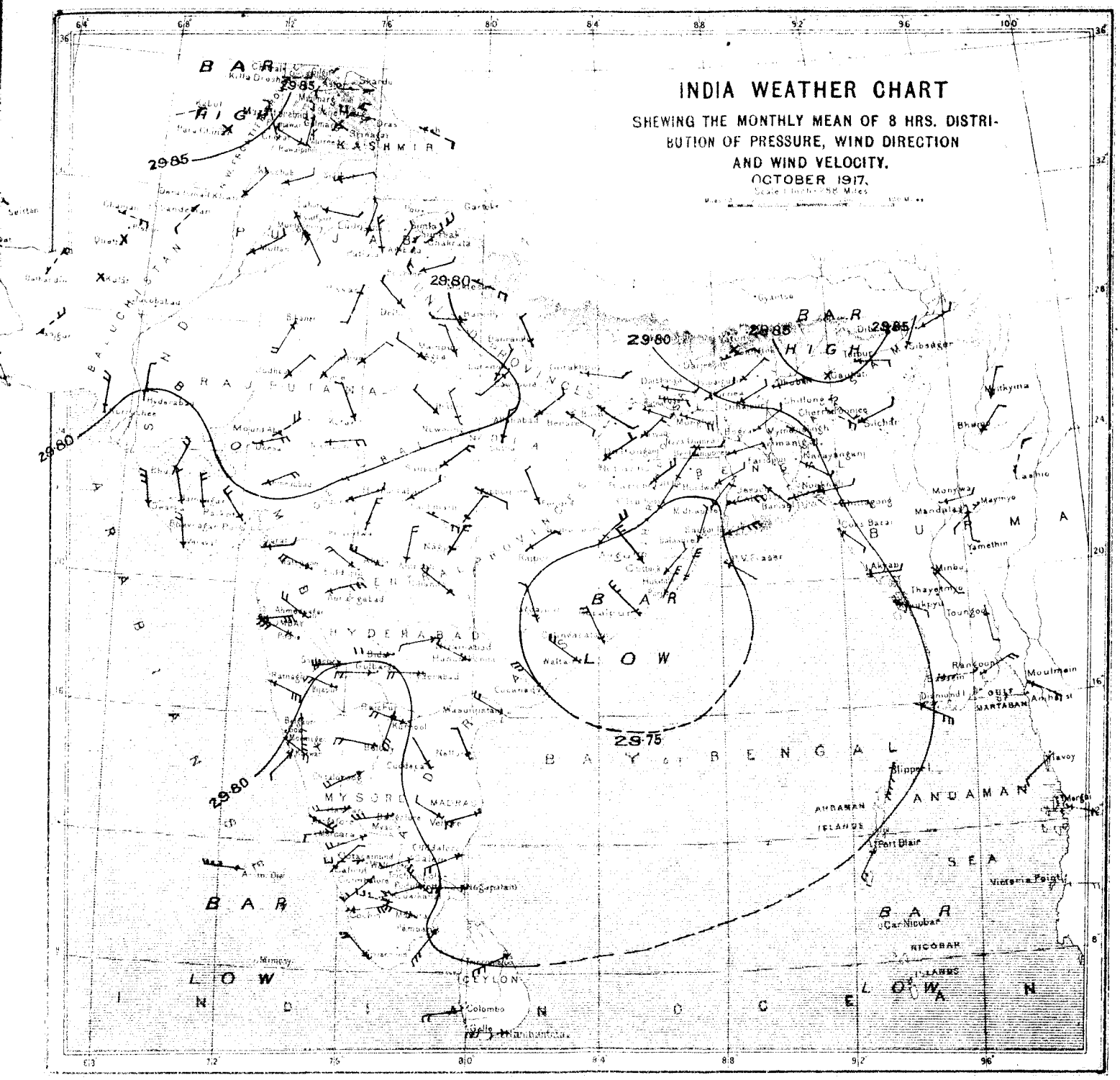
TABLE 18.

Name of pass or peak.	Depth of accumulation at the end of the month.	
	Reported.	Normal.
	Feet.	Feet.
Nuwe pass	17	22¾
Lampia ,,	15 or 16	8½
Lipulekh ,,	12 or 13	6⅓
Untadhura	6½	8
Ralamdhura	6½	5½
Binkaru pass	5	11
Milamdhura	1¾	7
Pindari peak	2	2¾
Kaphini ,,	2	3
Kuntela ,,	2	3
Bagdwar	1	...

SUMMARY.

15. There was heavy snow in Kashmir and on the Punjab Himalayas and about the normal amount in the United Provinces.

HEMRAJ.

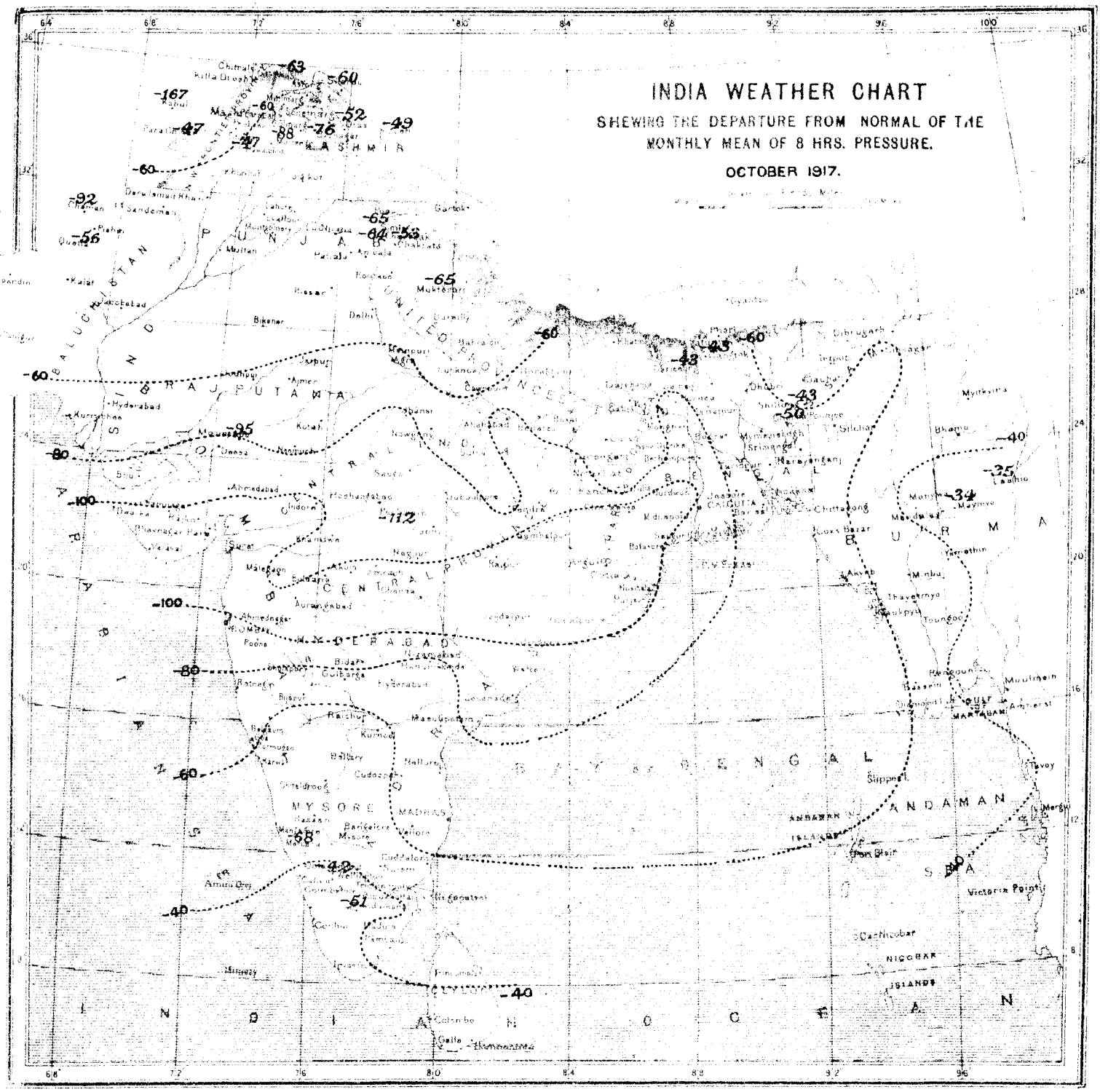


The lines of the above chart represent isobars or lines of equal barometric pressure, the numbers attached indicating the barometric pressure in inches and being drawn for differences of pressure of ·05 inch. The isobars in the Bay of Bengal are filled in by means of the shore observations, and by comparison with the normal distribution of pressure.

The mean 8 hrs. wind directions of the month are shewn by means of arrows flying with the wind, and are calculated by means of Lambert's formula applied to the winds as given in Table B of the 8 hrs. observations. The mean wind directions for the hill stations are indicated by broken arrows to distinguish them from the wind arrows for the plain stations. The mean velocity of the winds during the month is shewn by the following notation:—

Velocity of	0 to 2	miles per hour	...	one	feather	added to the wind arrow.				
,, ,,	2 to 5	,, ,, ,,	...	two	feathers	,,	,,	,,	,,	
,, ,,	5 to 10	,, ,, ,,	...	three	,,	,,	,,	,,	,,	
,, ,,	10 to 20	,, ,, ,,	...	four	,,	,,	,,	,,	,,	
	over 20	,, ,, ,,	...	five	,,	,,	,,	,,	,,	

Wind strengths are based on factor 2·2 for the standard type of Beckley Robinson anemograph, instead of 3·0 as used for this plate up to December 1911 inclusive.



The chart shows the departure from normal of the mean during the month of 8 hrs. pressure by means of lines drawn for equal amounts of departure. The numbers are given in thousandths of an inch, 20 representing ·020″ or two hundredths of an inch, &c. Continuous lines indicate that the pressure was in excess by amounts indicated by the numbers attached to the lines, and broken or dotted lines that it was in defect by amounts indicated by the numbers attached to the lines. Two parallel lines near to each other, one continuous and the other broken or dotted, represent the line of no departure, the dotted line facing the area of deficient pressure or negative departures.

CHART SHEWING THE DEPARTURE FROM NORMAL
OF THE MONTHLY MEAN OF DAILY
MAXIMUM TEMPERATURE.

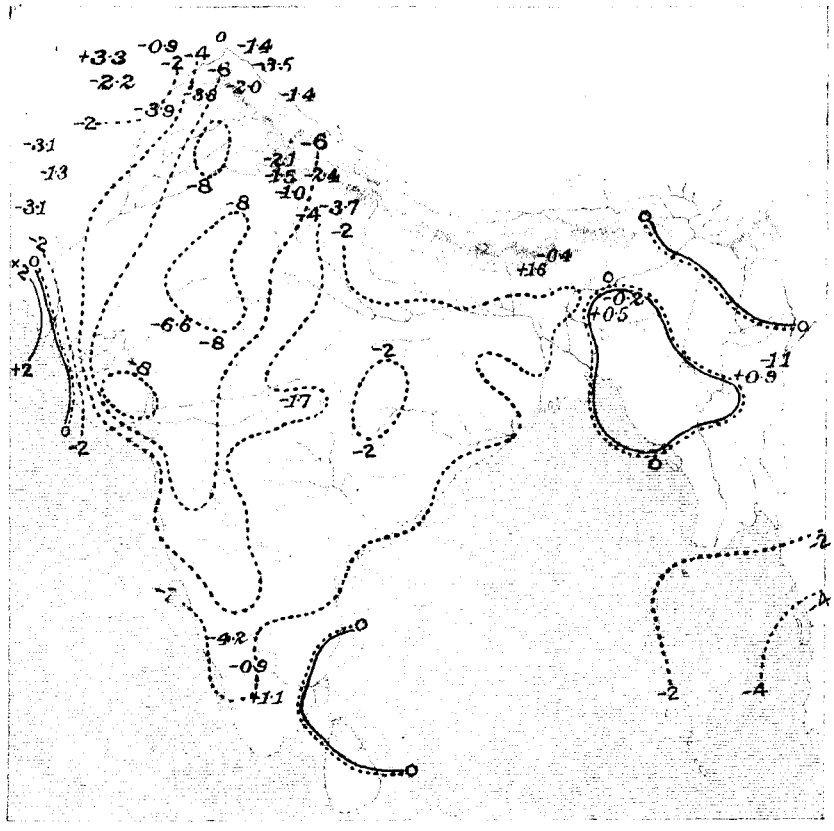


CHART SHEWING THE DEPARTURE FROM NORMAL
OF THE MONTHLY MEAN OF DAILY
MINIMUM TEMPERATURE.

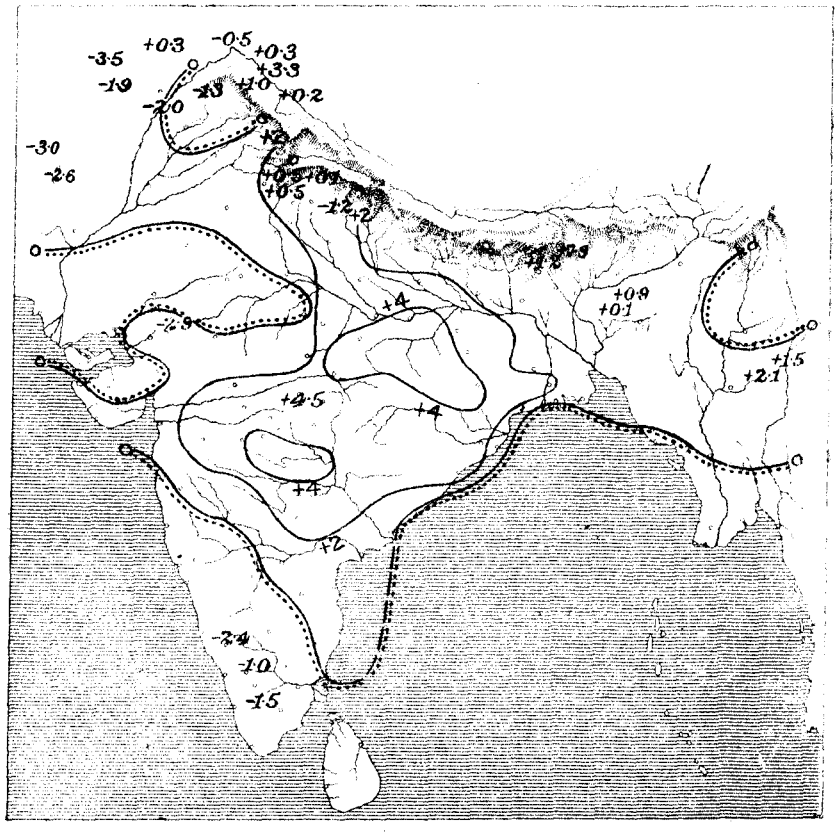


CHART SHEWING THE DEPARTURE FROM NORMAL
OF THE MONTHLY MEAN OF DAILY
MEAN TEMPERATURE.

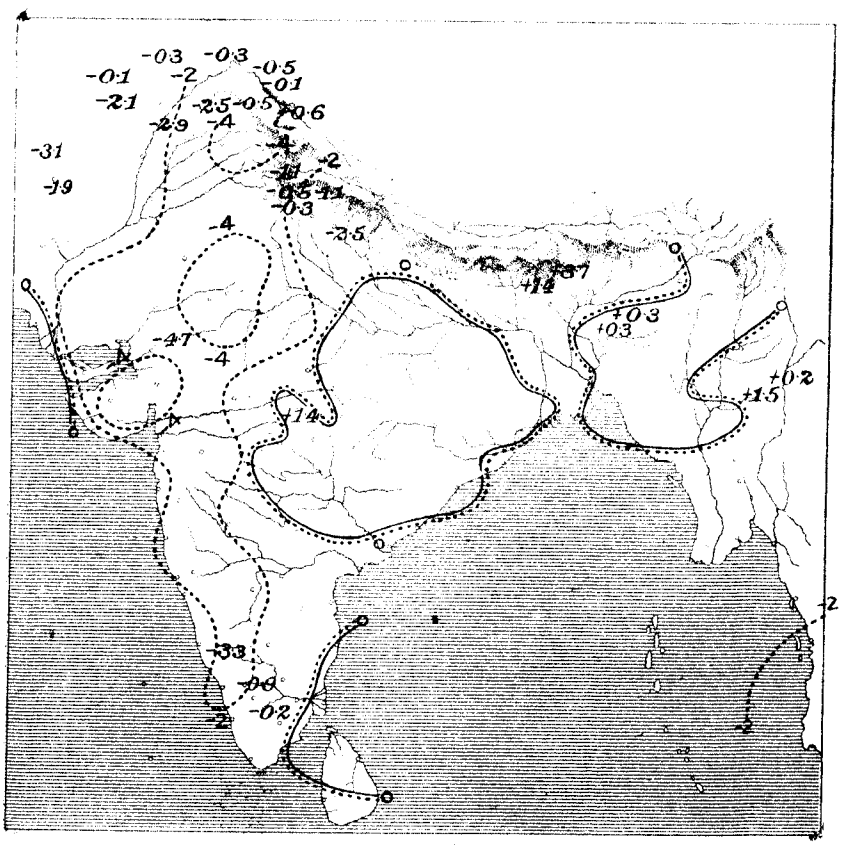


CHART SHEWING THE DEPARTURE FROM NORMAL
OF THE MONTHLY MEAN OF ABSOLUTE
HUMIDITY AT 8 HRS.

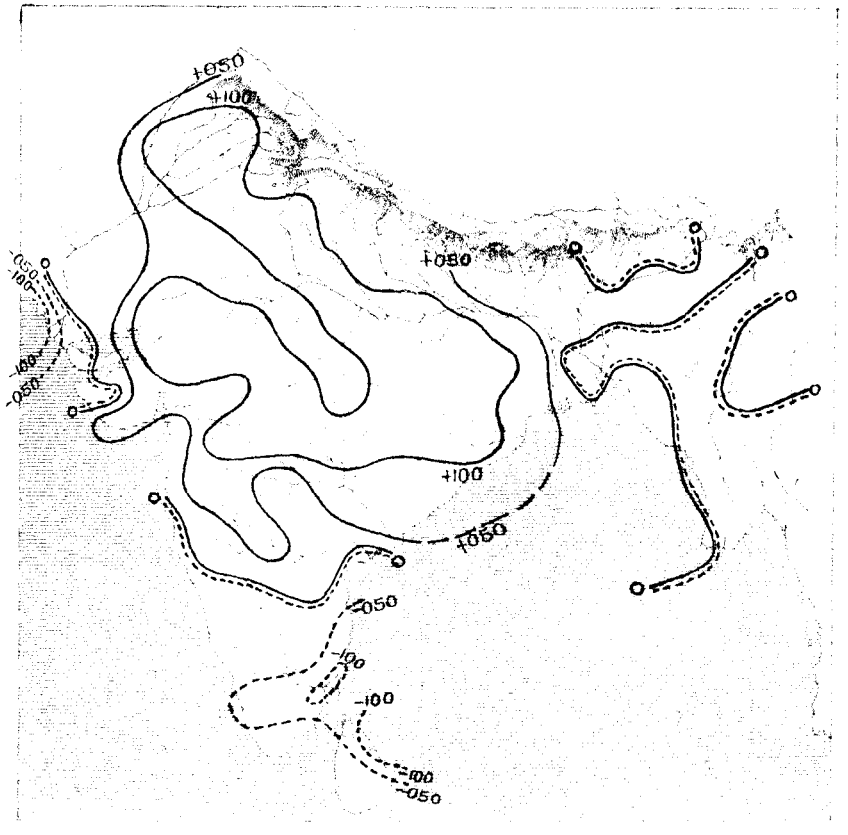


CHART SHEWING THE DEPARTURE FROM NORMAL
OF THE MONTHLY MEAN OF RELATIVE
HUMIDITY AT 8 HRS.

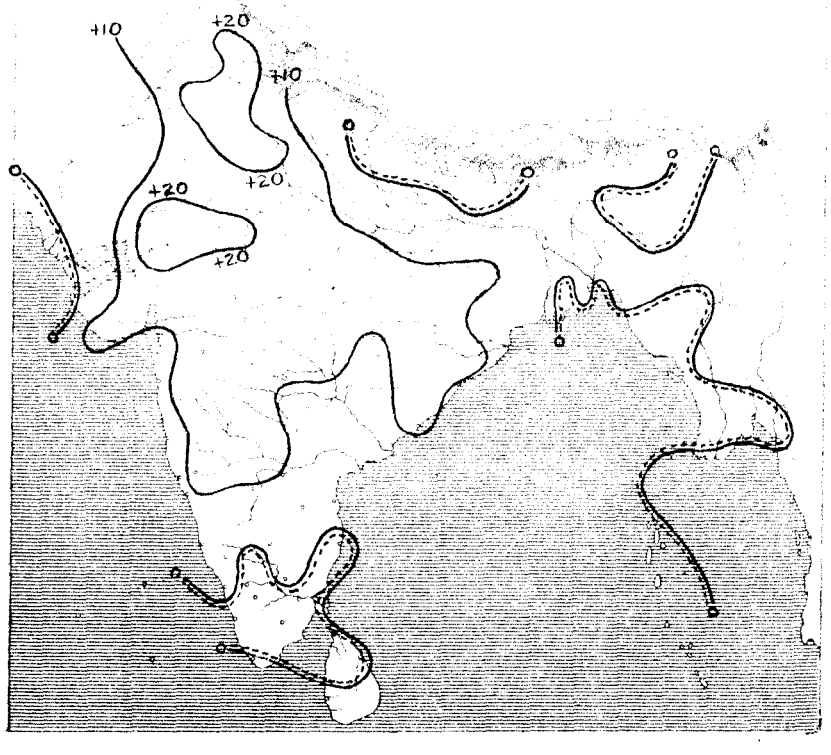


CHART SHEWING THE DEPARTURE FROM NORMAL
OF THE MONTHLY MEAN OF CLOUD
AMOUNT AT 8 HRS.

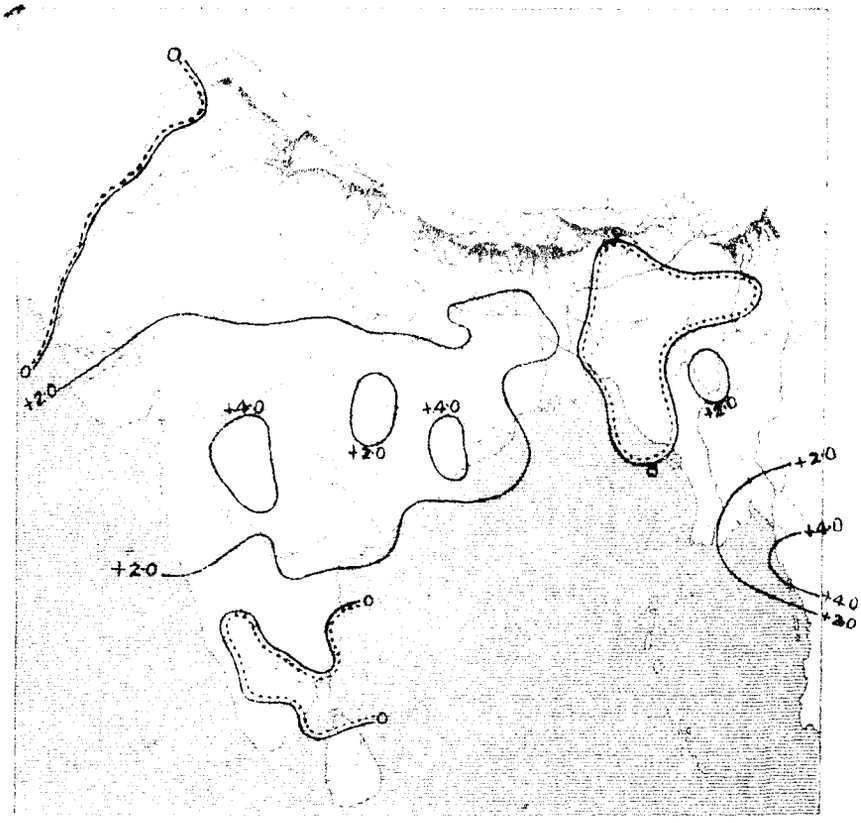
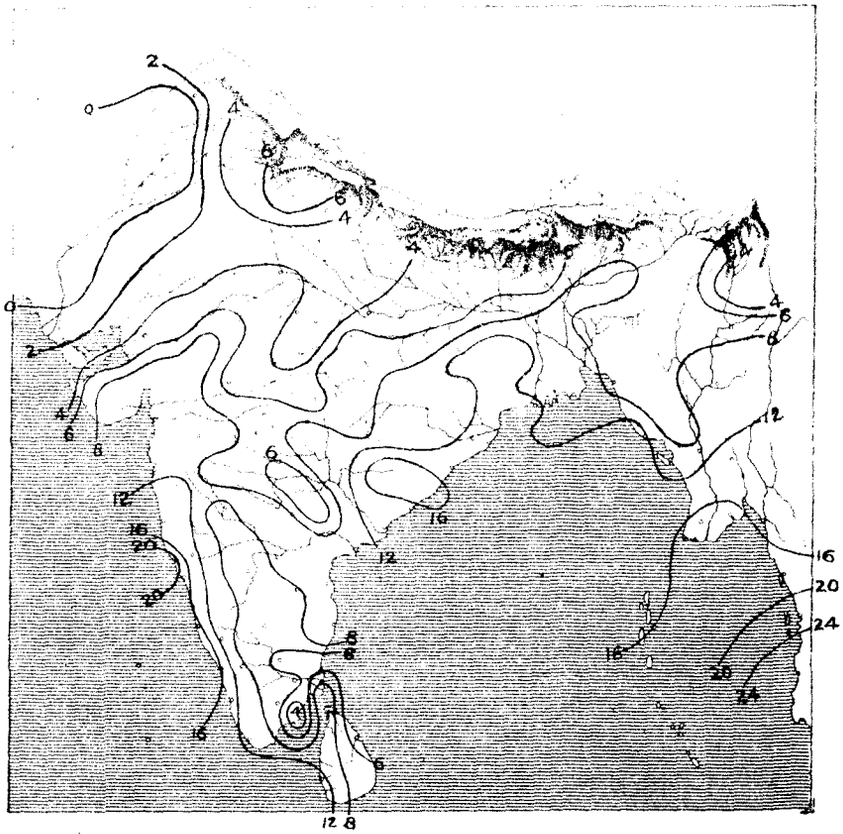
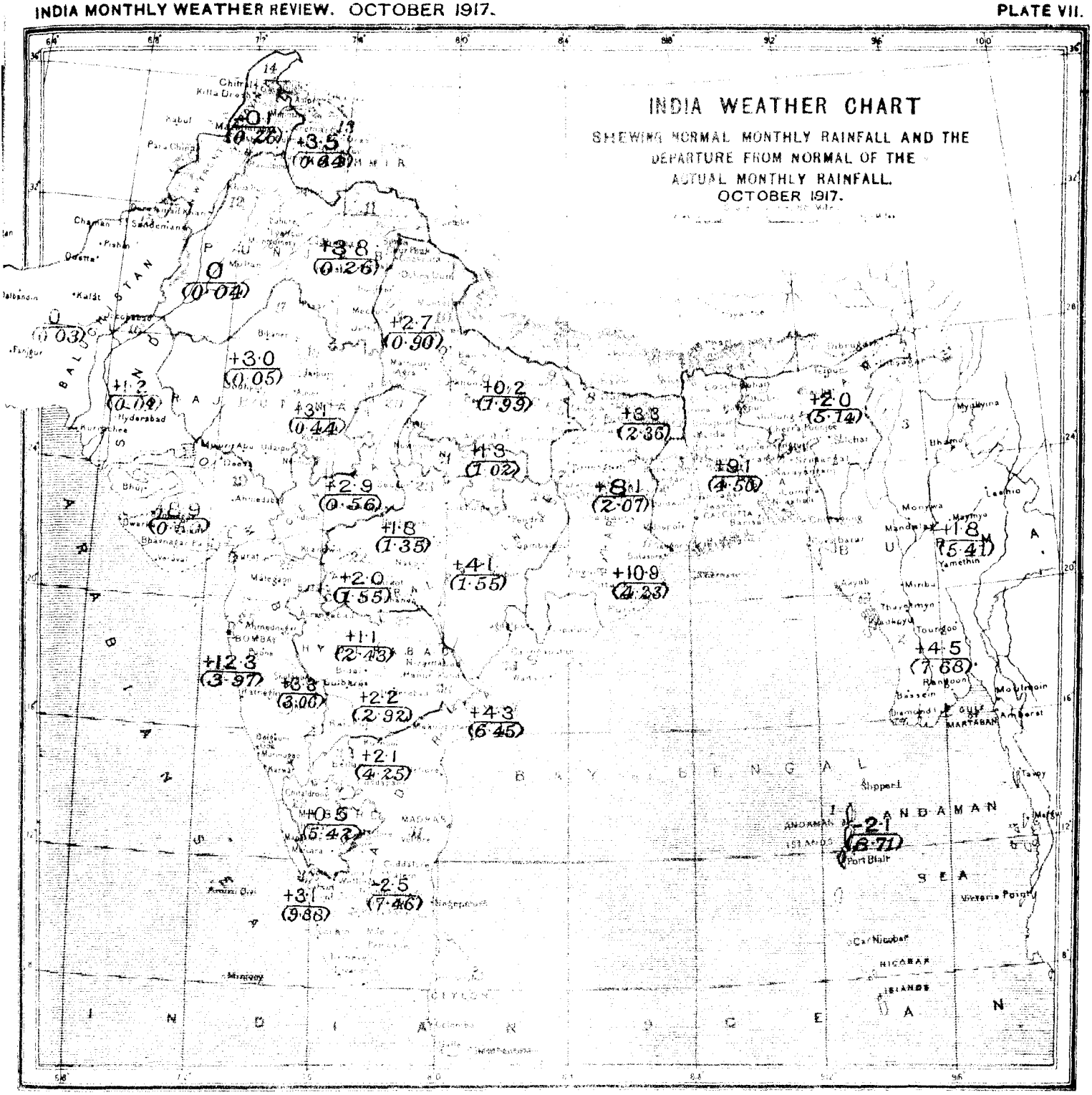


CHART SHEWING THE TOTAL NUMBER OF DAYS IN THE
MONTH ON WHICH RAINFALL EQUALLED OR
EXCEEDED 0·10 INCH.
(BASED ON THE RETURNS OF TABLE B.)





The country is divided into 33 areas as shewn in the list below. The numbers in that list correspond with the red numbers on the chart, and serve to identify the areas. The numbers in brackets on the chart give the average over the divisions of the normal monthly rainfall, the numbers above these give the departures from normal of the average actual rainfall over the divisions.

1. Bay Islands
2. Lower Burma
3. Upper Burma
4. Assam
5. Bengal
6. Orissa
7. Chota Nagpur
8. Bihar
9. United Provinces, East
10. United Provinces, West
11. Punjab, East and North
12. Do., Southwest
13. Kashmir
14. Northwest Frontier Province
15. Baluchistan
16. Sind
17. Rajputana, West
18. Rajputana, East
19. Gujarat
20. Central India, West
21. Do., East
22. Berar
23. Central Provinces, West
24. Do., East
25. Konkan
26. Bombay, Deccan
27. Hyderabad, North
28. Hyderabad, South
29. Mysore
30. Malabar
31. Madras, Southeast
32. Madras, Deccan
33. Madras Coast, North

GOVERNMENT OF INDIA

METEOROLOGICAL DEPARTMENT

MONTHLY WEATHER REVIEW

PUBLISHED BY ORDER OF

THE GOVERNMENT OF INDIA

CALCUTTA, NOVEMBER, 1917.

INTRODUCTION.

THIS review of the weather in India during the month of November, 1917, is based on observations taken daily at 8 hrs. at 217 stations, and on additional observations taken at 10 hrs. and 16 hrs. at 11 stations. In the rainfall summary have been utilized the data furnished by the meteorological observatories, and such rainfall statements of the month as had been published by the Provincial Governments up to the date of the preparation of the review.

The brief notes on solar, magnetic and seismic disturbances are supplied by the chief observatories in the Indian area.

For a statement of the methods adopted in recording and tabulating the data, for each of the elements of observation, reference should be made to the introductory portion of the review for January.

Summary of the chief features of the weather in India during the month.

2. The monsoon was very active in Assam and the greater part of the Peninsula, and gave abundant rain in those areas. A western disturbance gave some comparatively heavy rain towards the end of the month in Baluchistan. Over the rest of the country there was either no rain or the month's total was deficient.

A depression passed across the Bay in the second week of the month but did not develop into a storm.

Cloud amount was below normal in Assam and above it in Bihar; elsewhere it agreed generally with rainfall. Mean temperature was 3° or more below the average in the United Provinces, north-west India, Bombay and Central India, the departure from normal being as much as 8° in Kashmir and 6° in Rajputana East.

The mean barometric pressure over the plains of India was 0·019″ in defect.

Solar, magnetic and seismic disturbances.

KODAIKANAL OBSERVATORY.

3. *Solar Observations.*—The weather was comparatively not favourable for solar observations during the month. On 7 days no observations could be made and prominences could not be recorded on one other day.

Sunspots.—Twenty-four new groups of spots were observed as against twenty-eight in October. The daily average number was 5·4 and the average life of a spot was 6·5 days, the averages for the preceding month being 4·9 and 5·1 respectively. The distribution of the spots in latitude was as follows:—

TABLE 1.

—	0°–10°	11°–20°	21°–30°	Mean latitude.	Extreme latitudes.
North . . .	5	6	2	13°·7	6° & 24°
South . . .	2	6	3	16°·2	9° & 30°

Prominences.—Eighty-four large and three metallic prominences were recorded. The highest was 220″ and was observed on the 3rd at latitude + 20° east.

Magnetic disturbances.—There was a "great" disturbance on the 14th and "moderate" disturbances on the 12th, 13th, 19th and 25th to 28th.

S. SITARAMAYYA,
1st Assistant,
for *Director.*

Seismic records.

$\phi = 10°\ 13'\ 50''$; $\lambda = 77°\ 28'\ 00''$; $h = 2343$ m. *Subsoil* Rock.

Apparatus.—Milne's Horizontal Pendulum Seismograph.

TABLE 2.

	V	To	€	$\frac{r}{To^2}$
AN:				
AE:	9·76	17·3	1	2·7
AZ:				

Date.	Phase.	Time G. M. T.	Period (Sec.)	Amplitude (u). AN.	AE.	AZ.	Distance Δ (Km.)	Remarks.
1917.		h. m. s.						
Nov. 4th	i P	12 09 30	...	...	...	...	...	
	i L	12 12 54	...	...	.	...	...	
	M	12 18 12	...	...	1,320	...	...	
	F	13 29 12	...	...	...	...	...	
„ 14th	e P	5 36 42	...	...	...	...	...	Widening of line.
	F	5 38 12	...	...	...	...	...	
„ 16th	e P	3 38 12	...	...	...	...	...	
	i L	3 47 54	...	...	...	...	...	
	M	4 27 42	...	...	800	...	...	
	F	6 26 42	...	...	...	...	...	
„ 16th	e P	22 27 12	...	...	...	...	...	
	i L	22 33 06	...	...	...	...	...	
	M	22 47 24	...	...	50	...	...	
	F	23 11 36	...	...	...	...	...	
Nov. 18th	e P	3 07 00	...	...	...	...	...	Light stopped from 3 h. 9·5 m. to 3 h. 11·5 m. for marking time on sheet.
	L	.....	...	...	...	...	...	
	M	3 12 54½	...	...	320	...	...	
	F	4 09 06	...	...	...	...	...	
„ 24th	e P	11 47 12	...	...	...	...	...	Widening of line.
	F	11 53 30	...	...	...	...	...	
„ 28th	e P	15 01 48	...	...	...	...	...	Widening of line.
	F	15 12 36	...	...	...	...	...	

S. SITARAMAYYA,
1st Assistant.

BOMBAY OBSERVATORY.

Alibag magnetic record.

4. During the month of November 1917 the traces showed 12 calm days, 17 days of small and one day of moderate disturbance.

The days of the month selected as "quiet" for the purposes of the Magnetic Survey of India are the 4th, 9th, 16th, 18th and 30th.

The following table represents the magnetic character of each day during the month :—

TABLE 3.

Day.	Character.	Day.	Character.	Day.	Character.	Day.	Character.
1	S	9	C	17	S	25	S
2	C	10	C	18	C	26	S
3	C	11	S	19	S	27	S
4	C	12	M	20	S	28	S
5	C	13	S	21	C	29	S
6	S	14	S	22	S	30	C
7	S	15	C	23	C		
8	S	16	C	24	S		

C=calm ; S=small ; M=moderate ; G=great ; V. G=very great.

The mean observed absolute values of the several magnetic elements reduced to the mean monthly tabulations of the magnetograms, as also the ranges and the summed ranges of the horizontal force and the declination for the month are as follows :—

Easterly declination	0° 30′ 19″.
Horizontal force	0·36882 C.G.S. unit.
Vertical force	0·16905 C.G.S. „
Inclination	24° 37′·5.
Horizontal force range . . .	0·00063 C.G.S. unit.
Horizontal force summed range . .	0·00405 C.G.S. „
Declination range	1′·1.
Declination summed range . . .	6′·2.

(NOTE.—Summed range means sum without regard to sign of 24 ordinates of the diurnal inequality.)

Seismic records.

$\phi = 18° 53′ 36″$; $\lambda = 72° 48′ 56″$; $h = 11$m. *Subsoil* Trap.

Apparatus.—Milne's Horizontal Pendulum Seismograph.

TABLE 4.

	V	To	ϵ	$\frac{r}{To^2}$
AN:				
AE:	9	19	1	
AZ:				

Date.	Phase.	Time G. M. T.	Period (Sec.)	Amplitude (u). An.	Ac.	Az.	Distance △ (Km.)	Remarks.
1917.		h. m. s.						
Nov. 4th	P	12 9 26	...	...	...	...	...	
	S	12 14 2	...	...	...	...	...	
	M	12 20 53	...	...	856	...	...	
	F	13 40 34	...	...	...	...	...	
„ 6th	...	12 m 9 to 17 m	...	...	...	...	...	Thickening of line.
„ 16th	P	3 39 30	...	...	...	...	...	
	S	3 48 43	...	...	...	...	...	
	M	4 27 45	...	...	400	...	...	
	F	6 39 33	...	..	...	...	...	
„ „	P	...	...	...	...	...	...	P mixed in tremors.
	M	22 39 28	...	...	67	...	...	
	F	...	...	...	.	...	...	F mixed in tremors.
1917.		h. m. s.						
Nov. 18th	P	3 6 47	...	...	...	...	...	
	S	3 13 49	...	...	...	...	...	
	M	3 28 49	...	...	222	...	...	
	F	4 10 1	...	...	...	...	...	
„ 28th	P	*14 47 43	...	...	...	...	...	The time from Milne's record are uncertain as the disturbance occurred at shifting time.
	S	*14 52 16	...	...	...	...	...	
	M	...	...	...	...	...	...	
	F	...	...	...	...	...	...	

Sensibility to tilt 1·0 mm. of amplitude on the trace = 0″·32.

* These times are as shown by the float record (Tilt Seismograph).

N. A. F. MOOS,

Director,

Bombay and Alibag Observatories.

5.—CALCUTTA (ALIPORE) OBSERVATORY.

Seismic records.

$\phi = 22° 32′$ N; $\lambda = 88° 20′$ E; $h = 6·4m$. *Subsoil* Alluvial.

Apparatus.—Two Omori Ewing Horizontal Pendulum Seismographs.

TABLE 5.

	V	To	ϵ	$\frac{r}{To^2}$
AN:	29	18	1	
AE:	29	40	1	
AZ:				

Date.	Phase.	Time G. M. T.	Period (Sec.).	Amplitude (u). An.	Ae.	Az.	Distance Δ (Km.).	Remarks.
1917.		h. m. s.						
Nov. 4th	P	12 8 30	3	...	...	...	...	
	S	12 12 30	5	...	...	...	...	
	L	12 17 30	19	...	...	...	...	
	M	*12 22 36	...	672	741	...	...	*This is the time on the N. S. instrument. Time of maximum on E. W. instrument was 12h. 43 m. 18s.
	F	12 59 00	...	...	...	...	...	
„ 18th	P	3 4 36	3	...	...	...	...	
	S	3 10 36	5	...	...	...	...	
	L	3 16 24	12	...	...	...	...	
	F	3 37 0	...	...	...	...	...	

6.—SIMLA OBSERVATORY.

Seismic records.

$\phi = 31° 6' N$; $\lambda = 77° 11' E$; $h = 2{\cdot}2$ *km. Subsoil* Rock.

Apparatus.—Two Omori Ewing Horizontal Pendulum Seismographs (masses 50 kg.)

TABLE 6.

	V	To	C	$\frac{r}{To^2}$
AN:	14	45	1	
AE:	14	45	1	
AZ:				

Date.	Phase.	Time G. M. T.	Period (Sec.)	Amplitude (u). An.	Ae.	Az.	Distance Δ (Km.)	Remarks.
1917.		h. m. s.						
Nov. 15th	e	17 41 24	...	...	...	...	...	
	F	18 3 30	...	...	...	...	...	Slight tremors.
„ 16th	eP	3 39 30	...	...	...	...	...	
	S	3 49 30	...	...	...	...	...	
	L	3 56 30	...	...	...	...	...	
	M	3 56 42	24	...	86	...	...	
	M	3 49 42	...	...	129	...	...	
	F	6 5 42	...	...	...	...	...	
Nov. 16th	e	22 26 48	...	...	...	...	...	
	M	22 47 0	...	32	...	...	...	
	M	22 56 42	...	...	29	...	...	
	F	23 19 54	...	...	...	...	...	Tremors.
„ 18th	e	3 6 36	...	...	...	...	...	
	M	3 13 42	...	...	143	...	...	
	M	3 21 36	...	107	...	...	...	
	F	4 10 30	...	...	...	...	...	
„ 28th	e	14 50 36	...	...	...	...	...	
	M	14 52 24	...	68	...	...	...	
	F	15 8 42	...	...	...	...	...	

The following table contains a list of earthquakes that were reported :—

TABLE 7.

Place at which felt.	Date.	G. M. T. of earthquake.	Duration.	Intensity Rossi-Forel scale.	No. of shocks.	Remarks.
		h. m.	Sec.			
Salonah (Nowgong District, Assam).	Nov. 1st	23 31	10	6	2	
Narayanganj . .	„ 2nd	20 30	8	3	2 or 3	
Salonah (Nowgong District, Assam).	„ 7th	1 21	6	6	1	
Kabul (Afghanistan) .	„ 11th	22 54	20	7	2	
Shillong . . .	„ 25th	5 17	2	5	2	
„ .	„ 25th	10 22	1	4	1	
Meshed (Persia) . .	„ 28th	14 45	50	4	1	
„ „ . .	„ 28th	15 00	10	4	1	
„ „ . .	„ 28th	18 00	10	4	1	
„ „ . .	„ 28th	8 00	50	4	1	
„ „ . .	„ 29th	8 20	5	3	1	
„ „ . .	„ 29th	18 00	3	3	1	

Solar radiation.—Observations were not recorded owing to the absence of officers on war service.

C. W. B. NORMAND,
Imperial Meteorologist, Simla.

Weather in the Indian Ocean.

7. Pressure was normal at Zanzibar but in excess at Seychelles. Winds were weaker and somewhat more easterly than usual at Zanzibar, but at Seychelles they were of nearly double the normal strength and blew from a northwesterly direction instead of a southeasterly one. Rainfall was deficient at both stations. At Mauritius pressure, wind velocity and rainfall were in excess and the wind direction was more southerly than usual.

TABLE 8.

—	Mauritius.	Zanzibar.	Seychelles.
Departure from normal of mean pressure	+·033	−·001	+·022
Actual mean wind direction	S 65° E	S 76° E	N 43° W
Normal mean wind direction	S 85° E	S 45° E	S 56° E
Actual mean wind velocity (miles per diem).	226	65	170
Normal mean wind velocity (miles per diem).	182	82	93
Rainfall departure from normal	+1·41	−1·85	−3·72

Depressions and cyclonic storms.

8. A depression which entered the Andaman Sea from the east on the 7th moved westwards and was central about 200 miles off Madras on the 12th, causing squally weather there. It then moved north and on the 13th lay off Nellore where it remained almost stationary until its disappearance on the 16th. It caused 7 inches of rain at Masulipatam on the 14th.

A disturbance of the cold weather type entered India towards the end of the month and caused rain and snow in Baluchistan, the North-West Frontier Province and Kashmir on the 29th and the 30th.

Pressure.

9. The mean pressure of the month was appreciably below normal in Burma, north-east India, the Central Provinces and the Peninsula; it was above normal in Sind and normal elsewhere. The area of deficient pressure included the divisions where the monsoon was more active than usual.

The vertical pressure gradient was steep in north-west and central India and rather weak in north-east and southern India.

TABLE 9.

DIVISION.	Departure from normal of mean 8 hrs. pressure.
	"
Burma	−·040
Assam	−·038
Bengal	−·034
Bihar and Orissa	−·021
United Provinces	−·004
Punjab	+·001
North-West Frontier Province	+·001
Sind	+·020
Rajputana	+·003
Bombay	−·016
Central India	−·008
Central Provinces	−·023
Hyderabad	−·029
Mysore	−·033
Madras	−·039

TABLE 10.

HILL STATION.	Departure from normal pressure. A	PLAIN STATION.	Departure from normal pressure. B	Departure of pressure difference. B−A.
	"		"	"
Quetta	0	Jacobabad	+·019	+·019
Leh	+·003	Lahore	−·002	−·005
Murree	−·056	Peshawar	−·006	+·050
Simla	−·027	Ludhiana	+·003	+·030
Mukteswar	−·022	Bareilly	−·014	+·008
Darjiling	−·008	Dhubri	−·032	−·024
Mount Abu	−·035	Deesa	+·012	+·047
Pachmarhi	−·045	Khandwa	−·022	+·023
Kodaikanal	−·027	Madura	−·042	−·015

Temperature.

10. Both maximum and minimum temperatures were well below the average in north-west India on most days during the month. The mean monthly maximum temperature was generally below normal over the greater part of the country, the departure being 5° or over in Kashmir, the Punjab, Rajputana, the United Provinces West and Gujarat. The mean minimum was below normal by over 5° in Kashmir and Rajputana; it was 4° above normal in Upper Burma.

TABLE 11.

SUB-DIVISION.	ACTUAL TEMPERATURE.				DEPARTURE FROM NORMAL OF		
	Mean maximum.	Mean minimum.	Monthly mean of mean between maximum and minimum.	Mean daily range of temperature.	Maximum.	Minimum.	Daily range.
	°	°	°	°	°	°	°
1. Bay Islands	84·8	76·5	80·7	8·3	—1·2	—0·8	—0·4
2. Lower Burma	86·2	72·8	79·5	13·4	—0·2	+0·9	—1·1
3. Upper Burma	84·6	67·7	76·2	16·9	+0·9	+3·8	—2·9
4. Assam	82·4	62·5	72·5	19·9	+0·9	+1·5	—0·6
5. Bengal	82·6	65·8	74·2	16·7	—0·4	+1·6	—2·0
6. Orissa	82·7	65·4	74·0	17·3	—1·8	+1·8	—3·6
7. Chota Nagpur	79·4	57·3	68·4	22·1	—2·5	—0·3	—2·2
8. Bihar	81·3	59·6	70·4	21·7	—1·5	—0·7	—0·8
9. United Provinces, East	80·2	54·1	67·2	26·1	—3·1	—2·0	—1·1
10. Do. do., West	78·7	50·9	64·8	27·8	—4·6	—2·3	—2·3
11. Punjab, East and North	76·3	47·3	61·8	29·1	—5·7	—3·2	—2·5
12. Do., South-west	79·9	47·3	63·6	32·6	—4·5	—2·7	—1·8
13. Kashmir	51·8	24·7	38·2	27·1	—7·3	—8·4	+1·1
14. North-West Frontier Province	77·2	42·7	60·0	34·5	—2·7	—4·4	+1·7
15. Baluchistan	70·6	37·4	54·1	33·3	—2·5	—5·8	+3·3
16. Sind	84·1	56·1	70·1	28·0	—3·0	—3·0	0
17. Rajputana, West	82·3	54·8	68·5	27·5	—5·3	—4·1	—1·2
18. Do., East	80·0	50·3	65·1	29·6	—6·4	—5·8	—0·6
19. Gujarat	85·4	57·8	71·6	27·6	—5·0	—5·6	+0·6
20. Central India, West	81·0	50·3	65·6	30·7	—3·3	—4·3	+1·0
21. Do. do., East	77·9	49·7	63·7	28·2	—4·0	—3·9	—0·1
22. Berar	84·8	59·5	72·2	25·3	—0·6	—0·7	+0·1
23. Central Provinces, West	81·5	54·3	67·9	27·2	—2·4	—2·0	—0·4
24. Do. do., East	80·5	58·6	69·5	21·9	—2·1	—0·1	—2·0
25. Konkan	85·5	71·1	78·3	14·3	—1·9	—0·1	—1·8
26. Bombay Deccan	82·6	59·3	70·9	23·3	—3·2	—0·5	—2·7
27. Hyderabad, North	83·5	61·0	72·3	22·6	—1·3	+0·8	—2·1
28. Do., South	83·7	65·9	74·8	17·9	—2·3	+1·9	—4·2
29. Mysore	80·7	64·1	72·4	16·6	—0·6	+1·6	—2·2
30. Malabar	84·9	73·8	79·3	11·1	—1·5	+0·1	—1·6
31. Madras, South-east	85·8	73·1	79·5	12·7	—0·1	+1·3	—1·4
32. Do., Deccan	86·2	69·0	77·6	17·2	—2·0	+2·0	—4·0
33. Do., Coast, North	83·1	71·3	77·2	11·7	—1·3	+1·2	—2·5

TABLE 12.

DIVISION.	DEPARTURE FROM NORMAL OF		
	Mean maximum temperature.	Mean minimum temperature.	Mean temperature.
	°	°	°
Burma	+0·3	+2·2	+1·3
Assam	+0·9	+1·5	+1·2
Bengal	—0·4	+1·6	+0·6
Bihar and Orissa	—1·8	+0·2	—0·8
United Provinces	—3·8	—2·1	—2·9
Punjab	—5·5	—3·1	—4·3
North-West Frontier Province	—2·7	—4·4	—3·6
Sind	—3·0	—3·0	—3·0
Rajputana	—5·9	—5·1	—5·5
Bombay	—3·9	—3·2	—3·5
Central India	—3·7	—4·1	—3·9
Central Provinces	—1·9	—1·2	—1·5
Hyderabad	—1·9	+1·4	—0·2
Mysore	—0·6	+1·6	+0·5
Madras	—0·9	+1·1	+0·1

Winds.

11. Winds were stronger than usual in Burma and Assam, and weaker in the United Provinces, the North-West Frontier Province, Rajputana, Bombay, Central India and Hyderabad. Their steadiness was greater than the average in Assam, Bihar and Orissa, the United Provinces, the Punjab, the North-West Frontier Province, the Central Provinces and Hyderabad and less in Burma, Bengal, Rajputana, Central India, Mysore and Madras. The resultant wind directions were about normal nearly everywhere.

TABLE 13.

DIVISION.	DEPARTURE FROM NORMAL OF	
	Hourly wind velocity.	Wind steadiness.
Burma	+0·5	— 7
Assam	+0·6	+12
Bengal	—0·2	— 6
Bihar and Orissa	0	+ 7
United Provinces	—0·3	+19
Punjab	+0·1	+ 8
North-West Frontier Province	—0·9	+ 9
Sind	—0·2	— 1
Rajputana	—0·6	— 6
Bombay	—0·7	0
Central India	—0·7	— 5
Central Provinces	+0·1	+15
Hyderabad	—0·9	+16
Mysore	—0·5	—34
Madras	+0·4	— 5

Humidity and cloud.

12. Absolute humidity was appreciably above normal in Burma, the Bombay Deccan, Hyderabad, Mysore, the Madras Deccan and the north Madras coast, and below it in the United Provinces, the North-West Frontier Province, Sind, Gujarat, north Rajputana, Central India and the Central Provinces. Relative humidity was about normal in Burma, north-east India, the United Provinces, the North-West Frontier Province, Sind and the Central Provinces, and above it elsewhere.

Skies were less clouded than usual in the Bay Islands, Assam, north Bengal, the United Provinces, north-west India, Central India and parts of the Central Provinces and of southern India, and were more clouded elsewhere.

TABLE 14.

DIVISION.	HYGROMETRY; 8 HRS.				CLOUD.	
	Mean humidity.	Departure from normal.	Mean vapour tension in inches of mercury.	Departure from normal in inches of mercury.	Mean cloud amount at 8 hrs.	Departure from normal.
	%					
Burma	86	+ 1	·754	+·045	5·2	+1·3
Assam	90	0	·604	+·018	2·7	—0·8
Bengal	83	— 1	·637	+·011	2·3	+0·3
Bihar and Orissa	78	+ 3	·524	+·014	2·4	+1·0
United Provinces	72	+ 2	·384	—·026	0·2	—0·6
Punjab	72	+10	·304	—·004	0·4	—0·8
North-West Frontier Province.	67	+ 1	·235	—·053	0·7	—1·2
Sind	61*	+ 3	·371	—·036	0·1	—1·2
Rajputana	58	+ 8	·297	—·011	0·2	—0·9
Bombay	66	+ 7	·484	—·003	1·6	+0·1
Central India	65	+ 6	·330	—·036	0·4	—0·7
Central Provinces	60	— 1	·378	—·027	2·1	+0·3
Hyderabad	68	+ 5	·529	+·033	4·1	+1·8
Mysore	79	+ 4	·585	+·028	5·9	+0·9
Madras	83	+ 4	·754	+·030	5·1	+0·6

Rainfall.

13. The month's fall was in excess in Upper Burma, Assam, Baluchistan, the Konkan, the Bombay Deccan, Hyderabad North, Mysore and Madras, and was in defect by less than 25 per cent. in the Bay Islands, Lower Burma, Bengal, Orissa and Hyderabad South; over the rest of the country little or no rain fell.

A winter disturbance that passed through Persia towards the end of the month caused a few light falls of rain there; otherwise weather was dry in that country.

TABLE 15.

SUB-DIVISION.	NUMBER OF RAINY DAYS.		RAINFALL.			
	Actual.	Normal.	Actual.	Normal.	Departure from normal.	Percentage departure from normal.
			"	"	"	
1. Bay Islands	10·5	9·3	6·71	7·75	—1·04	— 13
2. Lower Burma	2·5	3·4	1·97	2·50	—0·53	— 20
3. Upper Burma	3·5	3·0	2·26	1·98	+0·28	+ 14
4. Assam	1·2	1·5	1·38	0·91	+0·47	+ 52
5. Bengal	0·7	0·8	0·52	0·67	—0·15	— 22
6. Orissa	0·9	1·0	0·67	0·83	—0·16	— 19
7. Chota Nagpur	0	0·4	0·04	0·20	—0·16	— 80
8. Bihar	0	0·3	0	0·18	—0·18	—100
9. United Provinces, East	0	0·3	0	0·16	—0·16	—100
10. Do. do., West	0	0·2	0	0·11	—0·11	—100
11. Punjab, East and North	0	0·2	0	0·10	—0·10	—100
12. Do., South-west	0	0·2	0	0·09	—0·09	—100

Sub-division.	Number of rainy days.		Rainfall.			
	Actual.	Normal.	Actual.	Normal.	Departure from normal.	Percentage departure from normal.
			"	"	"	
13. Kashmir	0	0·6	0·01	0·28	—0·27	— 96
14. North-West Frontier Province	0	0·5	0	0·32	—0·32	—100
15. Baluchistan	0·4	0·6	0·24	0·22	+0·02	+ 9
16. Sind	0	0·1	0	0·07	—0·07	—100
17. Rajputana, West	0	0·1	0	0·07	—0·07	—100
18. Do., East	0	0·2	0	0·11	—0·11	—100
19. Gujarat	0	0·3	0	0·18	—0·18	—100
20. Central India, West	0	0·3	0	0·18	—0·18	—100
21. Do., East	0·1	0·4	0·05	0·28	—0·23	— 82
22. Berar	0·2	0·8	0·08	0·52	—0·44	— 85
23. Central Provinces, West	0	0·6	0	0·41	—0·41	—100
24. Do., East	0·1	0·6	0·03	0·44	—0·41	— 93
25. Konkan	2·1	1·3	1·23	0·78	+0·45	+ 58
26. Bombay Deccan	2·6	1·3	1·91	0·76	+1·15	+151
27. Hyderabad, North	1·5	1·2	1·34	0·77	+0·57	+ 74
28. Do., South	1·4	1·7	0·75	0·94	—0·19	— 20
29. Mysore	5·3	3·3	3·67	2·12	+1·55	+ 73
30. Malabar	8·9	5·2	6·36	3·92	+2·44	+ 62
31. Madras, South-east	9·2	7·6	7·07	6·57	+0·50	+ 8
32. Do., Deccan	4·4	2·9	3·13	1·92	+1·21	+ 63
33. Do., Coast, North	5·7	3·2	4·91	3·19	+1·72	+ 54

TABLE 16.

Division.	Rainfall.			
	Actual.	Normal.	Departure from normal.	Percentage departure from normal.
	"	"	"	
Burma	2·15	2·18	—0·03	— 1
Assam	1·38	0·91	+0·47	+ 52
Bengal	0·52	0·67	—0·15	— 22
Bihar and Orissa	0·19	0·34	—0·15	— 44
United Provinces	0	0·13	—0·13	—100
Punjab	0	0·09	—0·09	—100
North-West Frontier Province	0	0·32	—0·32	—100

Division.	Rainfall.			
	Actual.	Normal.	Departure from normal.	Percentage departure from normal.
	"	"	"	
Sind	0	0·07	—0·07	—100
Rajputana	0	0·10	—0·10	—100
Bombay	1·17	0·58	+0·59	+102
Central India	0·03	0·23	—0·20	— 87
Central Provinces	0·03	0·45	—0·42	— 93
Hyderabad	1·01	0·85	+0·16	+ 19
Mysore	3·67	2·12	+1·55	+ 73
Madras	5·90	4·77	+1·13	+ 24
Mean of India	1·16	1·04	+0·12	+ 12

Snowfall.

I.—AFGHANISTAN.

14. Half an inch of snow fell at Kabul and on the surrounding hills on the 30th; this is considered by the local people as a normal fall for the month.

II.—BALUCHISTAN.

There was a slight fall of snow on all the hills round Quetta on the 29th and the 30th.

III.—NORTH-WEST FRONTIER PROVINCE.

(*a*) *Wano.*—About 7 inches of snow fell at a height of about 11,000 feet on the 30th on the hills near Marwatti, Pirghal, Bosh, Drinashtar and Karkani; this is considered a normal amount for the month. The snow melted away on the next day.

(*b*) *Kurram.*—Snow fell on the high peaks of the Sufed Koh on 3 days.

(*c*) *Drosh.*—Snow to a depth of 1 foot fell on the 30th on the neighbouring hills down to 12,000 feet.

IV.—KASHMIR.

(*a*) *Srinagar.*—No snow fell.

(*b*) *Skardu.*—No snow fell at the station or on the neighbouring ranges.

(*c*) *Dras.*—Nearly 2 inches of snow fell on the first.

(*d*) *Kargil.*—Snow fell on the 1st to a depth of about 2 inches on Archulla and Nakthulla and about 1 inch on all the other mountains around the station. The accumulation on the surrounding mountains at the end of the month was about 2 feet at Archulla, 1½ feet at Nakthulla, 1 foot at Samenulla, 6 inches at Barulla and 4 inches at Pazgolla and Narianulla.

V.—PUNJAB.

(*a*) *Kibba* (*Simla Hills*).—No snow fell.

(*b*) *Kulu* (*Kangra*).—Much snow fell in October-November in the Spiti valley between 10,000 and 13,500 feet.

VI.—UNITED PROVINCES.

Almora.—The total fall of the month was estimated at 1½ feet at Malla Durma, 2 feet at Malla Danpur, 5 feet at Chaudas, 2½ feet at Malla Johar and 10½ feet at Byans. The snowline descended from the perpetual snows to a distance of 8 miles in Malla Darma, 3 or 4 miles in Malla Danpur, three-quarters of a mile in Chaudas, 2½ miles in Malla Johar and 12 or 13 miles in Byans.

TABLE 17.

Name of pass or peak.	Approximate height.	Depth of accumulation at the end of the month.	
		Reported.	Normal.
	Feet.	Feet.	Feet.
Nuwe pass	...	12	25½
Lampia „	...	15½	10
Lipulekh „	16,780	12½	7½
Binkaru „	...	6	13½
Milamdhura	11,400?	4½	7
Bagdwar	...	4½	...
Pindari peak	...	2	2
Kaphini „	...	2	2
Kuntela „	...	2	2

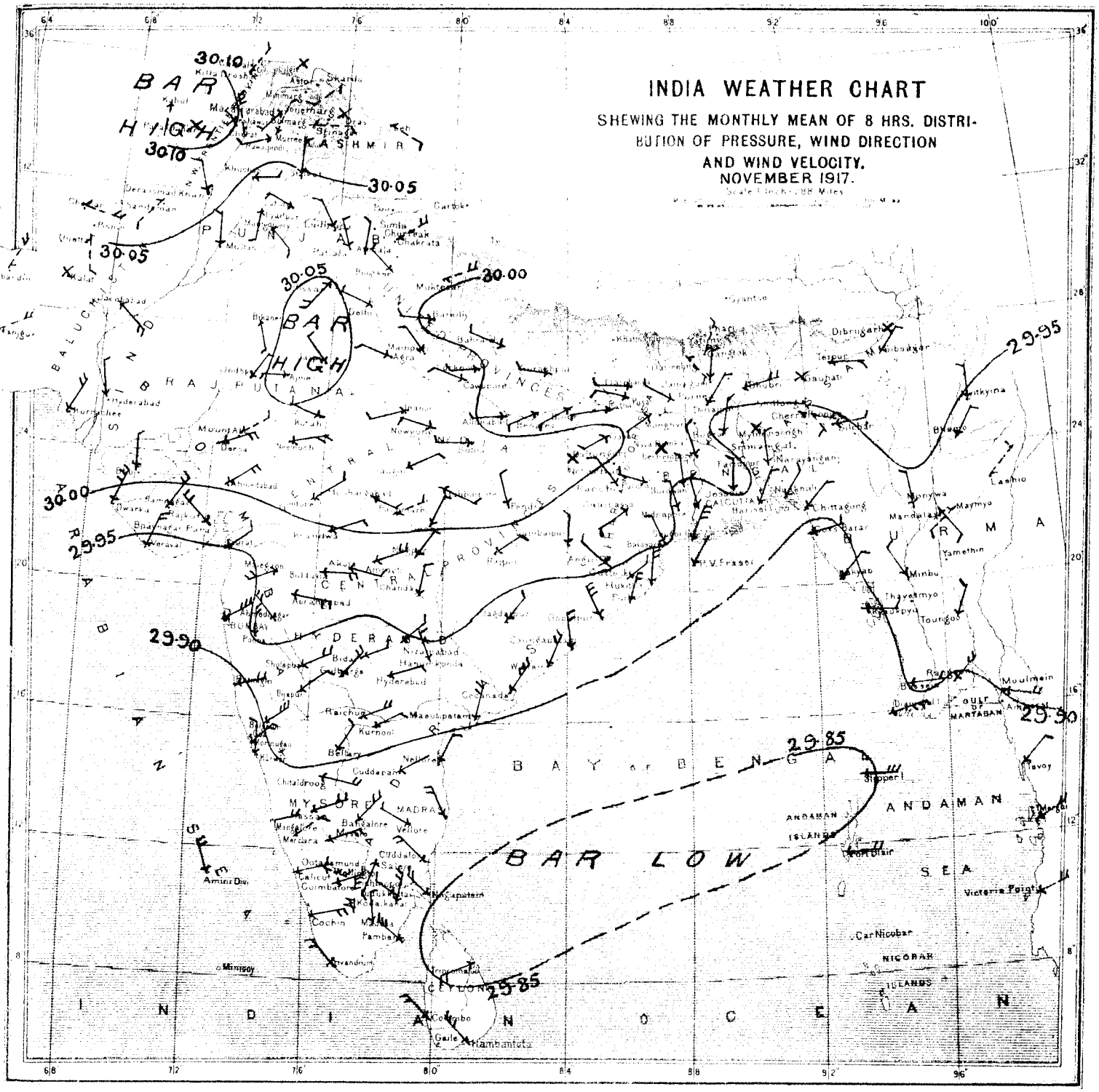
VII.—EASTERN HIMALAYAS.

Sikkim.—No snow fell at Gangtok and Yatung.

SUMMARY.

15. Snowfall was about normal in Afghanistan and the North-West Frontier Province and below it in Kashmir, the Punjab and the United Provinces.

S. SITARAMAYYA.

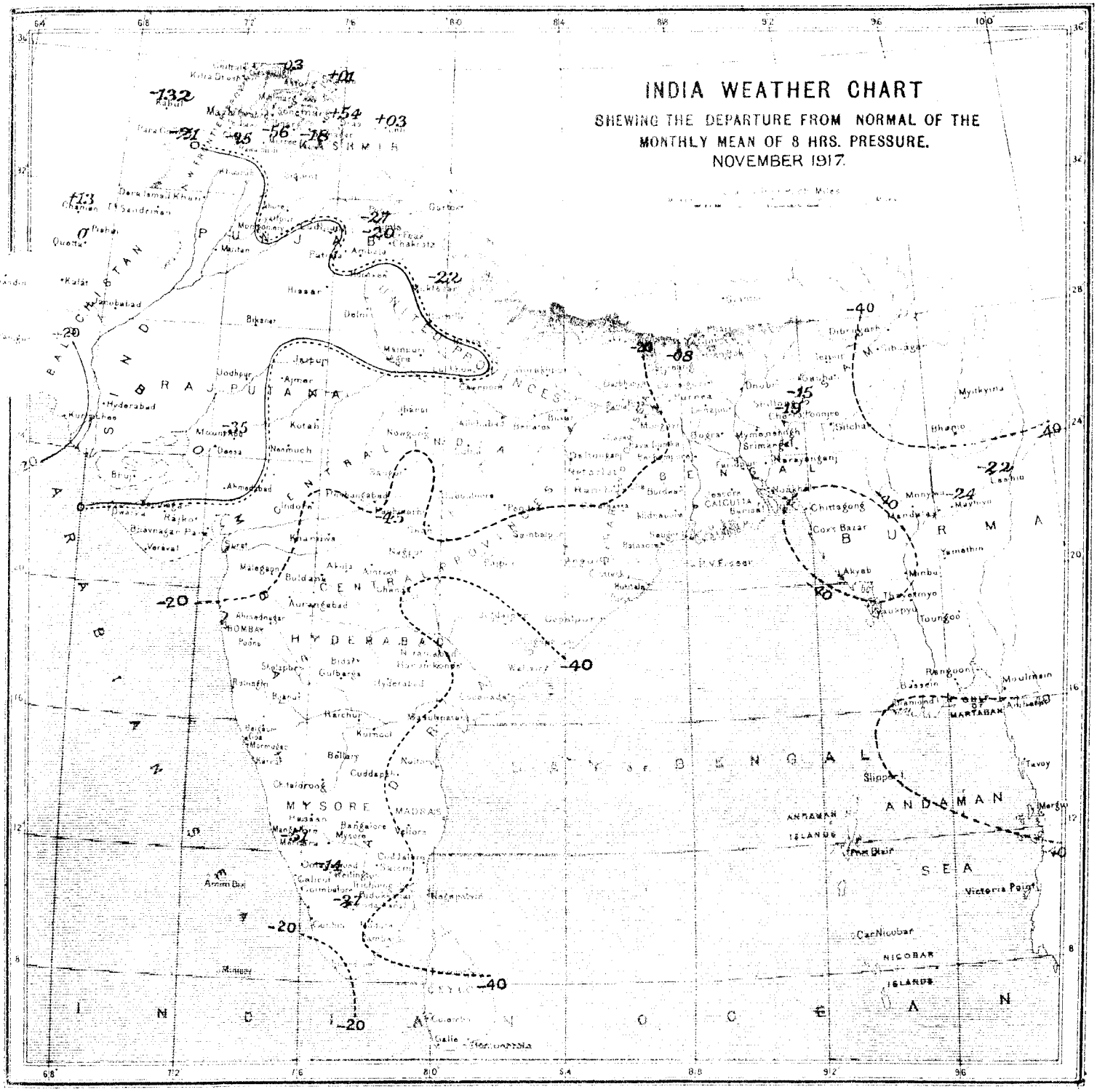


The lines of the above chart represent isobars or lines of equal barometric pressure, the numbers attached indicating the barometric pressure in inches and being drawn for differences of pressure of ·05 inch. The isobars in the Bay of Bengal are filled in by means of the shore observations, and by comparison with the normal distribution of pressure.

The mean 8 hrs. wind directions of the month are shewn by means of arrows flying with the wind, and are calculated by means of Lambert's formula applied to the winds as given in Table B of the 8 hrs. observations. The mean wind directions for the hill stations are indicated by broken arrows to distinguish them from the wind arrows for the plain stations. The mean velocity of the winds during the month is shewn by the following notation:—

Velocity of	0 to 2 miles per hour	...	one feather added to the wind arrow.
,, ,,	2 to 5 ,, ,, ,,	...	two feathers ,, ,, ,, ,,
,, ,,	5 to 10 ,, ,, ,,	...	three ,, ,, ,, ,, ,,
,, ,,	10 to 20 ,, ,, ,,	...	four ,, ,, ,, ,, ,,
	over 20 ,, ,, ,,	...	five ,, ,, ,, ,, ,,

Wind strengths are based on factor 2·2 for the standard type of Beckley Robinson anemograph, instead of 3·0 as used for this plate up to December 1911 inclusive.



The chart shows the departure from normal of the mean during the month of 8 hrs. pressure by means of lines drawn for equal amounts of departure. The numbers are given in thousandths of an inch, 20 representing ·020′ or two hundredths of an inch, &c. Continuous lines indicate that the pressure was in excess by amounts indicated by the numbers attached to the lines, and broken or dotted lines that it was in defect by amounts indicated by the numbers attached to the lines. Two parallel lines near to each other, one continuous and the other broken or dotted, represent the line of no departure, the dotted line facing the area of deficient pressure or negative departures.

CHART SHEWING THE DEPARTURE FROM NORMAL
OF THE MONTHLY MEAN OF DAILY
MAXIMUM TEMPERATURE.

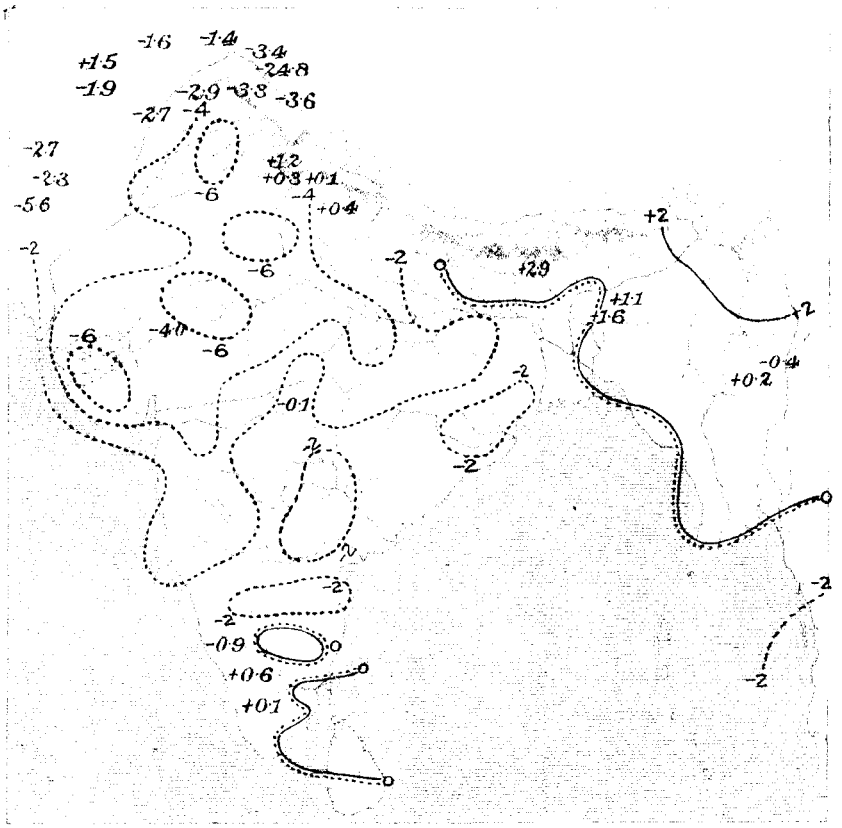


CHART SHEWING THE DEPARTURE FROM NORMAL
OF THE MONTHLY MEAN OF DAILY
MINIMUM TEMPERATURE.

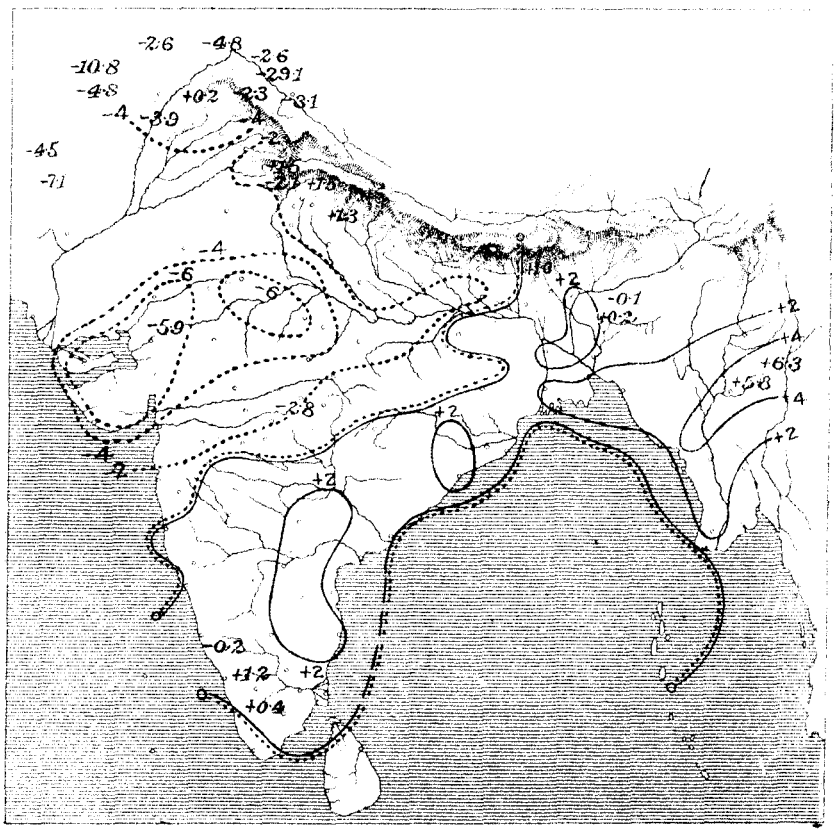


CHART SHEWING THE DEPARTURE FROM NORMAL
OF THE MONTHLY MEAN OF DAILY
MEAN TEMPERATURE.

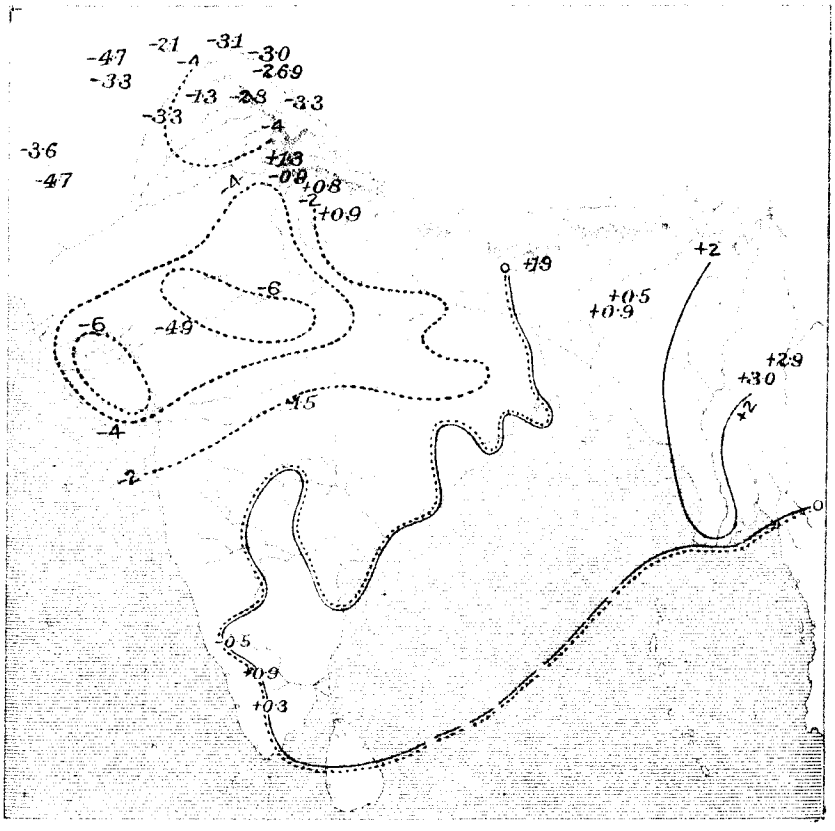


CHART SHEWING THE DEPARTURE FROM NORMAL
OF THE MONTHLY MEAN OF ABSOLUTE
HUMIDITY AT 8 HRS.

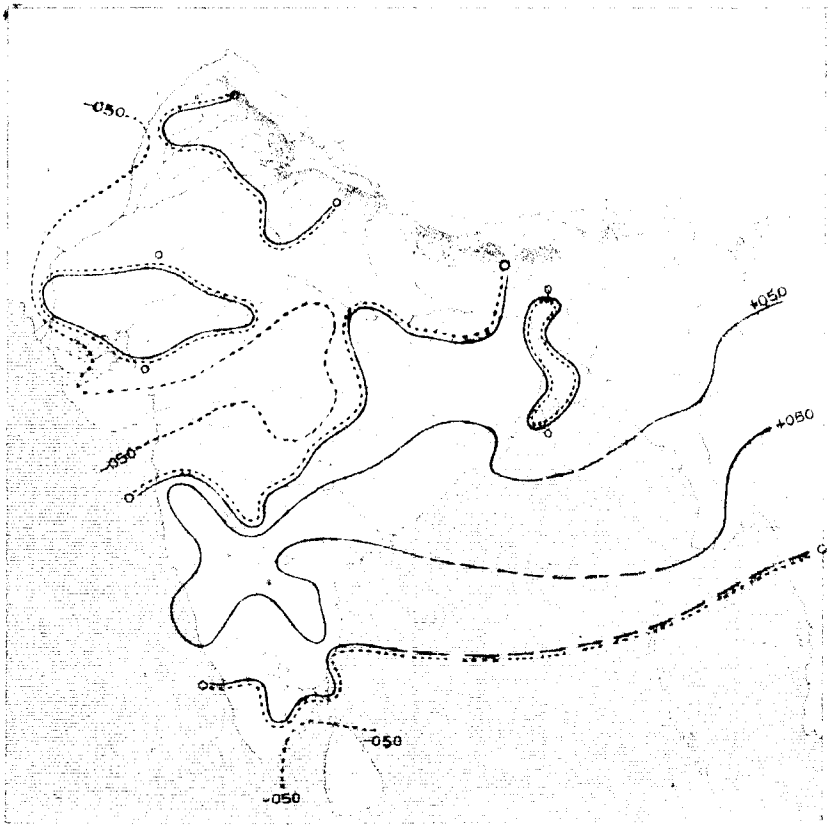


CHART SHEWING THE DEPARTURE FROM NORMAL
OF THE MONTHLY MEAN OF RELATIVE
HUMIDITY AT 8 HRS.

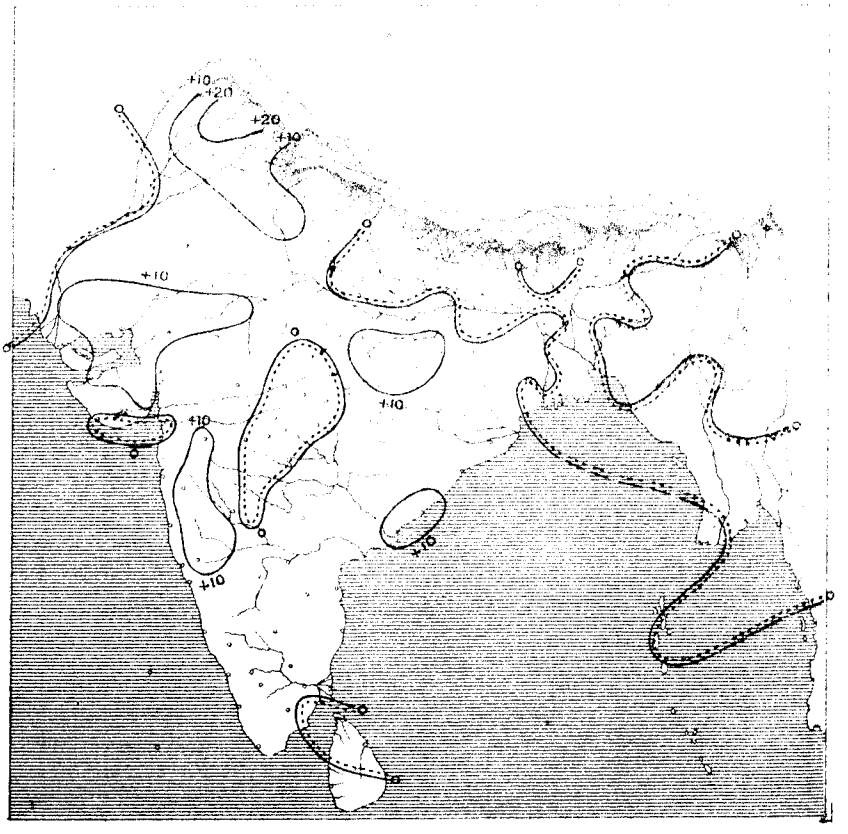


CHART SHEWING THE DEPARTURE FROM NORMAL
OF THE MONTHLY MEAN OF CLOUD
AMOUNT AT 8 HRS.

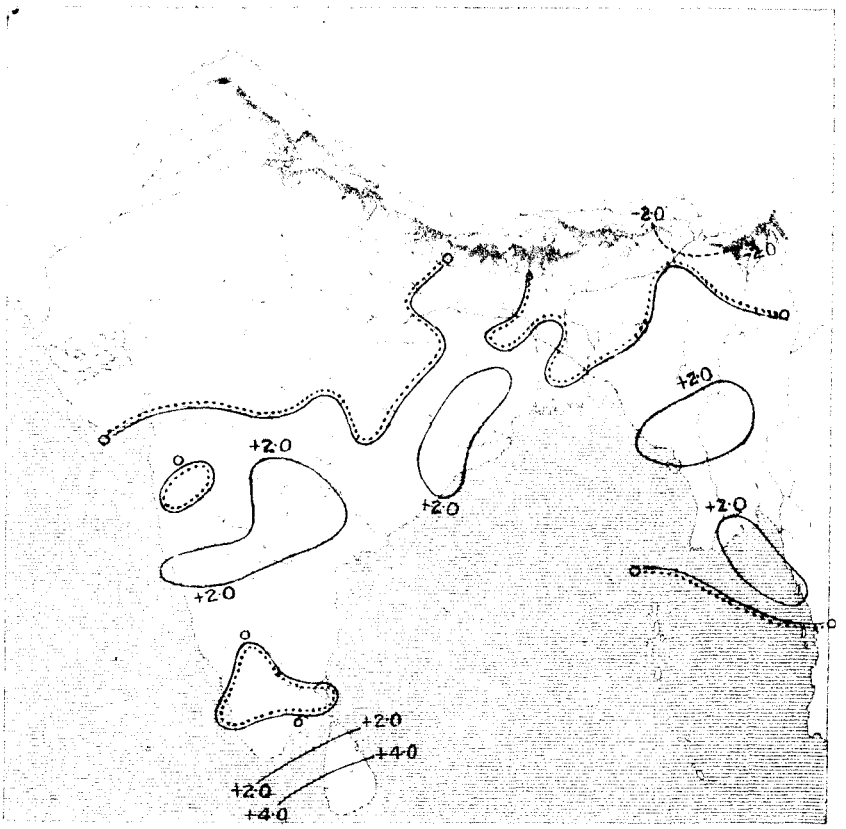
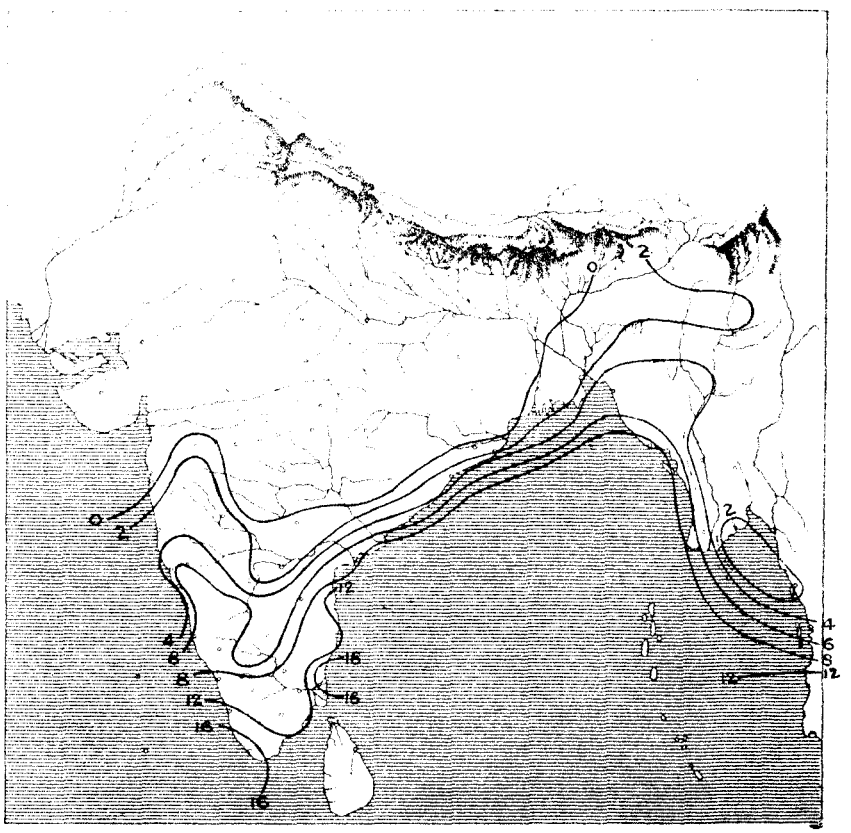
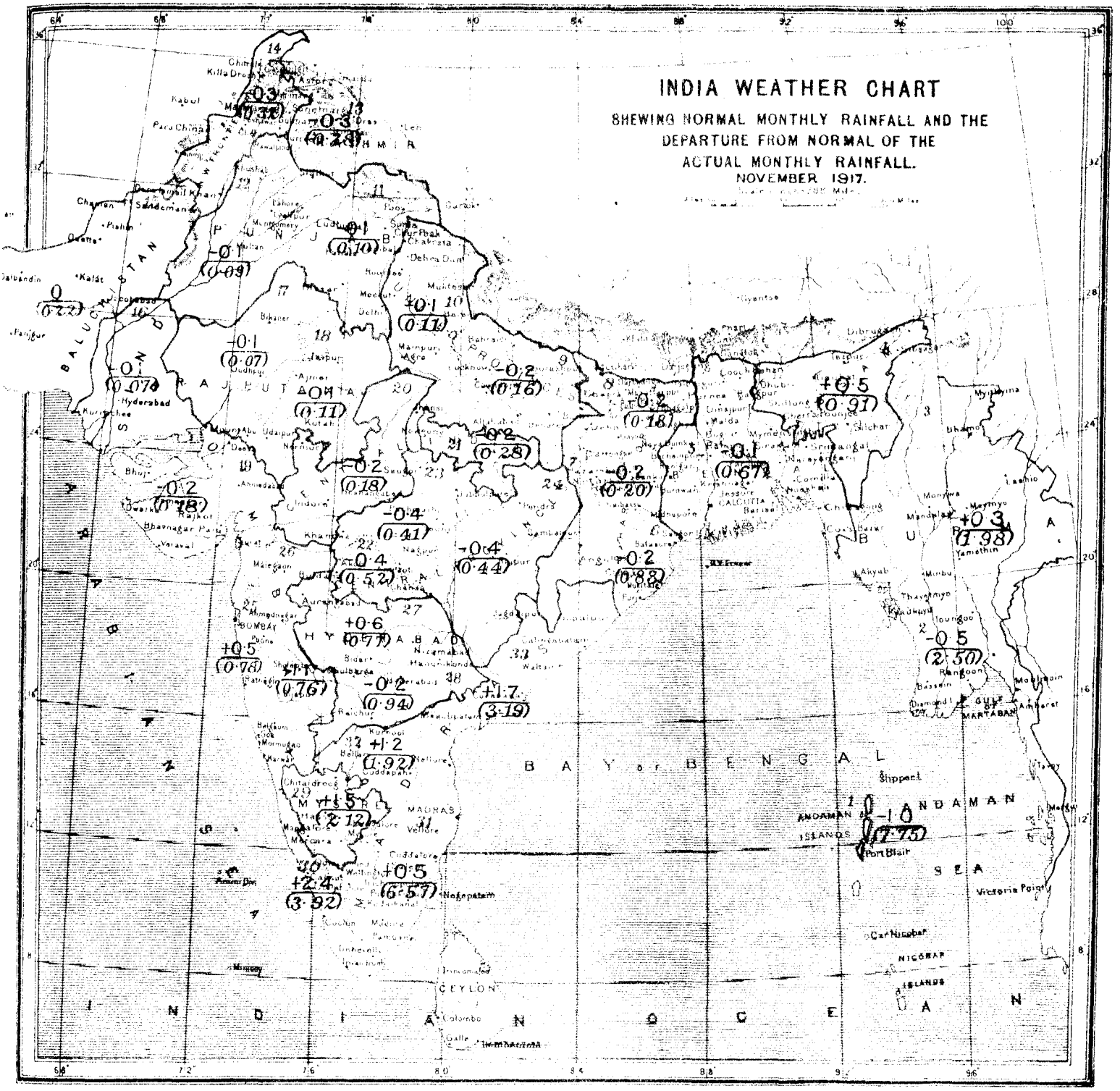


CHART SHEWING THE TOTAL NUMBER OF DAYS IN THE
MONTH ON WHICH RAINFALL EQUALLED OR
EXCEEDED 0·10 INCH.
(BASED ON THE RETURNS OF TABLE B.)





The country is divided into 33 areas as shewn in the list below. The numbers in that list correspond with the red numbers on the chart, and serve to identify the areas. The numbers in brackets on the chart give the average over the divisions of the normal monthly rainfall, the numbers above these give the departures from normal of the average actual rainfall over the divisions.

1. Bay Islands
2. Lower Burma
3. Upper Burma
4. Assam
5. Bengal
6. Orissa
7. Chota Nagpur
8. Bihar
9. United Provinces, East
10. United Provinces, West
11. Punjab, East and North
12. Do., Southwest
13. Kashmir
14. Northwest Frontier Province
15. Baluchistan
16. Sind
17. Rajputana, West
18. Rajputana, East
19. Gujarat
20. Central India, West
21. Do., East
22. Berar
23. Central Provinces, West
24. Do., East
25. Konkan
26. Bombay, Deccan
27. Hyderabad, North
28. Hyderabad, South
29. Mysore
30. Malabar
31. Madras, Southeast
32. Madras, Deccan
33. Madras Coast, North

GOVERNMENT OF INDIA

METEOROLOGICAL DEPARTMENT

MONTHLY WEATHER REVIEW

PUBLISHED BY ORDER OF

THE GOVERNMENT OF INDIA.

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INTRODUCTION.

THIS review of the weather in India during the month of December, 1917, is based on observations taken daily at 8 hrs. at 214 stations, and on additional observations taken at 10 hrs. and 16 hrs. at 12 stations. In the rainfall summary the data furnished by the meteorological observatories, and such rainfall statements of the month as had been published by the Provincial Governments up to the date of the preparation of the review have been utilized.

The brief notes on solar, magnetic and seismic disturbances are supplied by the chief observatories.

For a statement of the methods adopted in recording and tabulating the data, for each of the elements of observation, reference should be made to the introductory portion of the review for January.

Summary of the chief features of the weather in India during the month.

2. The cold weather disturbance which had entered India towards the end of November gave on the 1st December some rain and snow in Kashmir and widespread rain in the North-West Frontier Province and Baluchistan. Three more disturbances of this type affected the weather in northern India between the 19th and the end of the month; the rainfall due to them occurred mainly in Baluchistan, the North-West Frontier Province, Kashmir and the Punjab.

The total rainfall of the month was below normal over almost the whole country; taking the plains of India as a whole the actual fall was less than half the normal amount.

Cloud amount was generally below the average. Humidity was appreciably in excess in northwest and central India, and in defect in Mysore. Mean temperature was mostly within 2° of the normal.

Solar, magnetic and seismic disturbances.

KODAIKANAL OBSERVATORY.

3. *Solar Observations.*—No solar observations could be made on two days during the month and prominences could not be recorded on three days.

Sunspots.—Thirty-nine new groups of spots were observed as against twenty-four in November. The daily average number was 9·1 and the average life of a spot was 6·6 days, the averages for the preceding month being 7·6 and 5·4 respectively. The distribution of the spots in latitude was as follows:—

TABLE 1.

—	0°—10°	11°—20°	21°—30°	31°—40°	Mean latitude.	Extreme latitudes.
North . .	9	5	4	...	12°·8	5° & 25°
South . .	5	11		2	15°·7	5° & 32°

Prominences.—One hundred and two large, one eruptive, and eleven metallic prominences were recorded in the month. The highest was an eruptive prominence which was observed on the 6th at latitude—82° west and which stretched as a slender streak to a height of 420″ at 8h. 40m. I. S. T.

Magnetic disturbances.—One prolonged "great" disturbance was recorded from the 16th to 21st and "moderate" disturbances on the following days:—3rd to 4th, 8th to 9th, 11th and 30th.

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Kodaikanal and Madras Observatories.

Seismic records.

$\phi = 10° 13' 50''$; $\lambda = 77° 28' 00''$; $h = 2{,}343$m.
Subsoil Rock.

Apparatus.—Milne's Horizontal Pendulum Seismograph.

TABLE 2.

	V	To	ϵ	$\frac{r}{To^2}$
AN:				
AE:	9·76	17·4	1	2·5
AZ:				

Date.	Phase.	Time G. M. T.	Period (Sec.).	Amplitude (u). An.	Ae.	Az.	Distance Δ (Km.).	Remarks.
1917.		h. m. s.						
Dec. 1st	e P	9 57 48	...	...	..	...	...	
	e L	10 01 12	...	...	...	...	...	
	M	10 02 42	..	...	30	...	...	
	F	10 08 18	...	...	...	...	...	
„ 5th	e P	13 07 06	...	...	...	...	...	Widening of line.
	F	13 13 18	...	...	...	...	...	
„ 19th	e P	10 01 00	...	...	...	...	...	Widening of line.
		10 05 05	...	...	...	...	...	
„ 20th	P	...	...	...	...	...	...	
	e L	2 56 00	...	...	...	...	...	
	M	3 00 36	...	...	90	...	...	
	F	3 12 24	...	...	...	...	...	
Dec. 21st	e P	18 19 12	...	...	...	...	...	
	e L	18 50 30	...	...	...	...	...	
	M	19 00 48	...	...	200	...	...	
	F	20 21 18	...	...	...	...	...	
„ 21st	e P	21 51 06	...	...	...	...	...	Widening of line.
	F	21 54 42	...	...	...	...	...	
„ 28th	P	...	...	...	...	...	...	
	e L	22 10 00	...	...	...	...	...	
	M	22 19 24	...	...	90	...	...	
	F	22 43 18	...	...	...	...	...	
„ 29th 30th	e P	23 28 00	...	...	...	...	...	
	e L	0 25 06	...	...	...	...	...	
	M	0 43 06	...	...	150	...	...	
	F	1 05 24	...	...	...	...	...	

S. SITARAMAYYA,
Offg. Assistant Director.

BOMBAY OBSERVATORY.

Alibag magnetic record.

4. During the month of December, 1917, the traces showed 10 calm days, 18 days of small, 2 days of moderate and 1 day of great disturbance.

The days of the month selected as "quiet" for the purposes of the Magnetic Survey of India are the 1st, 10th, 13th, 22nd and 31st.

The following table represents the magnetic character of each day during the month.

TABLE 3.

Day.	Character.	Day.	Character.	Day.	Character.	Day.	Character.
1	C	9	S	17	M	25	C
2	S	10	C	18	M	26	S
3	S	11	S	19	S	27	S
4	S	12	S	20	S	28	C
5	S	13	C	21	S	29	S
6	S	14	S	22	C	30	S
7	S	15	C	23	C	31	C
8	S	16	G	24	C		

C = calm ; S = small; M = moderate, G = great ; V. G. = very great.

The mean observed absolute values of the several magnetic elements reduced to the mean monthly tabulations of the magnetograms, as also the ranges and the summed ranges of the horizontal force and the declination for the month are as follows :—

Easterly declination	0° 30′ 17″.
Horizontal force	0·36874 C. G. S. unit.
Vertical force	0·16918 C. G. S. unit.
Inclination	24° 38′·7.
Horizontal force range	0·00061 C. G. S. unit.
Horizontal force summed range	0·00403 C. G. S. unit.
Declination range	1′·9.
Declination summed range	9′·4.

(NOTE.—Summed range means sum without regard to sign of the twenty-four ordinates of the diurnal inequality.)

Seismic records.

$\phi = 18° 53′ 36″$; $\lambda = 72° 48′ 56″$; $h = 11$m.

Subsoil Trap.

Apparatus.—Milne's Horizontal Pendulum Seismograph.

TABLE 4.

	V	To	ϵ	$\frac{r}{To^2}$
AN:				
AE:	9	19	1	
AZ:				

Date.	Phase.	Time, G. M. T.	Period (Sec.)	Amplitude (u). An.	Ae.	Az.	Distance Δ (Km.).	Remarks.
1917.		h. m. s.						
Dec. 1st	P	*9 52 22	...	...	...	...	...	
	S	9 56 15	...	...	...	...	...	
	M	9 58 15	...	...	22	...	...	
	F	10 4 31	...	...	...	...	...	
„ 14th	P	8 8 52	...	...	...	...	...	
	M	8 14 27	...	...	44	...	...	
	F	8 24 48	...	...	...	...	...	
„ 21st	P	18 16 3	...	...	...	...	...	
	M	18 52 48	...	...	178	...	...	
	F	19 51 49	...	...	...	...	...	
„ 21st	P	21 46 7	...	...	...	...	...	
Dec. 21st	M	21 47 19	...	...	44	...	...	
	F	22 6 7	...	...	...	...	...	
„ 28th	...	11 32 to 36	...	...	...	...	...	Thickening of line.
„ 28th	P	...	...	...	...	...	...	P mixed in tremors.
	M	22 9 37	...	...	111	...	...	
	F	...	...	...	...	...	...	F mixed in tremors.

One disturbance at about 29·23½h is masked by tremors.

* This time is as shown by the float record. (Tilt Seismograph).

Sensibility to tilt 1·0 mm. of amplitude on the trace = 0·32″.

N. A. F. MOOS,
Director,
Bombay and Alibag Observatories.

5. CALCUTTA (ALIPORE) OBSERVATORY.

Seismic records.

$\phi = 22° 32′$ N ; $\lambda = 88° 20′$ E; $h = 6·4$ *m. Subsoil* Alluvial.

Apparatus.—Two Omori Ewing Horizontal Pendulum Seismographs.

TABLE 5.

	V	To	ϵ	$\frac{r}{To^2}$
AN:	29	18	1	
AE:	29	40	1	
AZ:				

Date.	Phase.	Time, G. M. T.	Period (Sec.).	Amplitude (u). An.	Ae.	Az.	Distance Δ (Km.)	Remarks.
1917.		h. m. s.						
Dec. 4th	P	9 24 54	2	...	...	...	...	
	S	9 25 54	4	...	...	...	...	
	F	9 43 48	...	...	...	...	...	

6.—SIMLA OBSERVATORY.

Seismic records.

$\phi = 31° 6' N$; $\lambda = 77° 11' E$; $h = 2{\cdot}2$ *km. Subsoil* Rock.

Apparatus.—Two Omori-Ewing Horizontal Pendulum Seismographs (Masses 50 Kg.).

TABLE 6.

	V	To	ϵ	$\frac{r}{To^2}$
AN:	14	45	1	
AE:	14	45	1	
Az:				

Date.	Phase.	Time G. M. T.	Period (Sec.).	Amplitude (u). An.	Ae.	Az.	Distance. Δ (Km.).	Remarks.
1917.		h. m. s.						
Dec. 28th	e	21 38 30	...	...	...	...	...	
	M	22 2 14	...	...	46	...	...	
	M	22 10 0	...	75	...	...	...	
	F	22 27 30	...	...	...	...	...	
„ 29th	e	23 13 24	...	...	...	...	...	
„ 30th	M	0 1 30	...	286	...	...	...	
	M	0 4 0	...	.	400	...	...	
	F	1 6 42	...	...	...	...	...	

The following table contains a list of earthquakes that were reported:—

TABLE 7.

Place at which felt.	Date.	G. M. T. of earthquake.	Duration.	Intensity Rossi-Forel scale.	No. of shocks.	Remarks.
		h. m.	sec.			
Meshed (Persia) .	Dec. 5th	2 00	5	3	1	
Shillong . .	„ 8th	11 56	1	5	1	
„ . . .	„ 10th	1 4	1	5	1	
„ . . .	„ 14th	0 52	1	5	1	
„ . . .	„ 15th	11 47	1	5	1	
Drosh . . .	„ 17th	6 00	10	6	3	
Shillong . .	„ 18th	5 52	1	5	1	
Srinagar . . .	„ 26th	15 24	4	6	1	
Poo (Bashahr State, Simla District).	„ 30th	21 30	3	6	1	

Solar radiation.—Observations were not recorded owing to absence of officers on war service.

C. W. B. NORMAND,
Imperial Meteorologist, Simla.

Weather in the Indian Ocean.

7. Pressure was in defect at all the three stations. Winds were normal at Mauritius and Seychelles, but at Zanzibar they were weaker and more northerly than usual. Rainfall was somewhat deficient at Seychelles and much below the average at Zanzibar and Mauritius.

TABLE 8.

——	Mauritius.	Zanzibar.	Seychelles.
Departure from normal of mean pressure	—·027	—·023	—·021
Actual mean wind direction . .	S 84° E	N 39° E	N 37° W
Normal mean wind direction . .	S 88° E	N 85° E	N 44° W
Actual mean wind velocity (miles per diem).	179	96	105
Normal mean wind velocity (miles per diem).	186	110	109
Rainfall departure from normal . .	—3·56	—5·03	—1·93

Depressions and cyclonic storms.

8. Six western disturbances affected the weather in northwest India during the month. The first had appeared at the end of November and continued to give rain or snow along the northwest frontier on the 1st. The second and third disturbances gave hardly any rain. The last three (17th to 20th, 22nd to 25th and 27th to 30th) produced rain or snow in Baluchistan, the North-West Frontier Province, the Punjab and Kashmir with occasional falls in the United Provinces and the Central Provinces.

No well-formed depressions appeared over the Indian seas during the month.

Pressure.

9. Pressure was below normal over the country generally on most of the days, and on the mean of the month it was much below the average in all the divisions. The deficiency was fairly evenly distributed; it was least, 0·031″, in Sind and greatest, 0·059″, in the Central Provinces. On the average of all the recording stations in the plains the defect was 0·050″.

The vertical pressure gradient was steep in northwest India but normal elsewhere.

TABLE 9.

DIVISION.	Departure from normal of mean 8 hrs. pressure.
	″
Burma	—·057
Assam	—·057
Bengal	—·055
Bihar and Orissa	—·050
United Provinces	—·050
Punjab	—·047
North-West Frontier Province	—·043
Sind	—·031
Rajputana	—·044
Bombay	—·043
Central India	—·053
Central Provinces	—·059
Hyderabad	—·052
Mysore	—·043
Madras	—·052

TABLE 10.

HILL STATION.	Departure from normal pressure. A	PLAIN STATION.	Departure from normal pressure. B	Departure of pressure difference. B—A.
	″		″	″
Quetta	—·048	Jacobabad	—·029	+·019
Leh	—·035	Lahore	—·052	—·017
Murree	—·086	Peshawar	—·046	+·040
Simla	—·042	Ludhiana	—·043	—·001
Mukteswar	—·038	Bareilly	—·053	—·015
Darjiling	—·043	Dhubri	—·053	—·010
Mount Abu	—·053	Deesa	—·031	+·022
Pachmarhi	—·067	Khandwa	—·054	+·013
Kodaikanal	—·047	Madura	—·054	—·007

Temperature.

10. Maximum temperature was 2° or more below normal in the Bombay Deccan and in northwest India excluding Rajputana. Minimum temperature was 2½° lower than usual in Baluchistan. Elsewhere temperature conditions were about normal.

TABLE 11.

SUB-DIVISION.	ACTUAL TEMPERATURE.				DEPARTURE FROM NORMAL OF		
	Mean maximum.	Mean minimum.	Monthly mean of mean between maximum and minimum.	Mean daily range of temperature.	Maximum.	Minimum.	Daily range.
	°	°	°	°	°	°	°
1. Bay Islands	83·6	75·5	79·6	8·1	—1·1	—0·9	—0·2
2. Lower Burma	83·9	67·3	75·6	16·6	—0·5	+0·2	—0·7
3. Upper Burma	79·1	54·5	66·8	24·7	0	—1·0	+1·0
4. Assam	75·3	53·4	64·3	21·9	+0·6	+0·9	—0·3
5. Bengal	77·4	55·8	66·6	21·6	—0·2	+0·3	—0·5
6. Orissa	79·6	56·8	68·2	22·8	—0·2	—0·3	+0·1
7. Chota-Nagpur	76·1	49·5	62·8	26·6	—0·3	—0·8	+0·5
8. Bihar	75·3	50·8	63·1	24·5	—0·4	0	—0·4
9. United Provinces, East	74·5	48·2	61·4	26·3	—0·7	—0·1	—0·6
10. Do. do., West	74·0	47·2	60·6	26·9	—0·8	+0·5	—1·3
11. Punjab, East and North	69·0	44·3	56·7	24·7	—2·2	+0·9	—3·1
12. Do., Southwest	70·2	43·2	56·7	26·9	—2·3	+0·6	—2·9
13. Kashmir	37·6	18·3	27·9	19·3	—3·0	—1·3	—1·7
14. North-West Frontier Province	65·7	40·5	53·1	25·1	—4·0	+0·7	—4·7
15. Baluchistan	59·7	33·8	46·8	26·0	—3·7	—2·7	—1·0
16. Sind	75·9	50·8	63·4	25·1	—2·1	—1·3	—0·8
17. Rajputana, West	76·5	51·1	63·9	25·4	—0·9	—0·4	—0·5
18. Do., East	76·1	49·1	62·6	27·0	—0·7	—0·9	+0·2
19. Gujarat	82·0	55·7	68·9	26·3	—2·3	—0·9	—1·4
20. Central India, West	78·7	49·6	64·1	29·1	—0·4	+0·2	—0·6
21. Do. do., East	75·3	47·5	61·4	27·8	+0·1	+0·5	—0·4
22. Berar	83·2	57·2	70·2	26·0	+1·1	+1·6	—0·5
23. Central Provinces, West	79·9	52·4	66·1	27·4	+0·7	+1·2	—0·5
24. Do. do., East	79·2	52·2	65·7	27·0	+0·2	+1·0	—0·8
25. Konkan	84·7	67·0	75·9	17·7	—1·2	—1·3	+0·1
26. Bombay Deccan	82·1	54·3	68·2	27·7	—2·0	—0·9	—1·1
27. Hyderabad, North	83·2	56·7	69·9	26·5	+0·6	+0·4	+0·2
28. Do., South	83·3	60·4	71·8	22·9	—0·8	+0·2	—1·0
29. Mysore	80·6	58·2	69·4	22·4	+0·1	—0·7	+0·8
30. Malabar	86·1	71·2	78·7	15·0	—0·9	—0·5	—0·4
31. Madras, South-east	83·9	68·1	76·0	15·8	0	—0·9	+0·9
32. Do., Deccan	85·6	61·8	73·7	23·8	—0·8	—0·2	—0·6
33. Do. Coast, North	80·4	65·4	72·9	15·0	—1·1	—0·3	—0·8

TABLE 12.

DIVISION.	DEPARTURE FROM NORMAL OF		
	Mean maximum temperature.	Mean minimum temperature.	Mean temperature.
	°	°	°
Burma	—0·3	—0·4	—0·3
Assam	+0·6	+0·9	+0·6
Bengal	—0·2	+0·3	0
Bihar and Orissa	—0·3	—0·3	—0·5
United Provinces	—0·7	+0·1	—0·4
Punjab	—2·3	+0·8	—0·7
North-West Frontier Province	—4·0	+0·7	—1·7
Sind	—2·1	—1·3	—1·7
Rajputana	—0·8	—0·6	—0·8
Bombay	—2·0	—1·0	—1·6
Central India	—0·1	+0·4	+0·1
Central Provinces	+0·7	+1·2	+1·0
Hyderabad	—0·2	+0·3	0
Mysore	+0·1	—0·7	—0·3
Madras	—0·5	—0·6	—0·6

Winds.

11. Winds were stronger than usual in Burma, the Punjab and Madras and of about the average strength in Assam, Bihar and Orissa and the Central Provinces; elsewhere they were weaker than usual. They blew with more than the average steadiness in Assam, the Punjab, Sind, Rajputana and Hyderabad and less steadily than usual in Bengal, Central India, Mysore and Madras. Wind directions were mostly normal.

TABLE 13.

DIVISION.	DEPARTURE FROM NORMAL OF	
	Hourly wind velocity.	Wind steadiness.
Burma	+0·4	0
Assam	+0·1	+ 9
Bengal	—0·2	— 8
Bihar and Orissa	0	— 2
United Provinces	—0·2	+ 1
Punjab	+0·7	+ 9
North-West Frontier Province	—0·9	— 1
Sind	—0·4	+10
Rajputana	—0·3	+ 8
Bombay	—0·7	— 2
Central India	—0·7	—14
Central Provinces	0	+ 8
Hyderabad	—1·0	+ 7
Mysore	—0·4	—18
Madras	+0·4	— 5

Humidity and cloud.

12. Both absolute and relative humidity were in excess in northwest India excluding Sind and in defect in Mysore; relative humidity was in excess in Central India.

Cloud amount was in defect except in Burma and the North-West Frontier Province where it was in excess and in Assam, Bihar and Orissa, the Punjab and Madras where it was about normal.

TABLE 14.

DIVISION.	HYGROMETRY; 8 HRS.				CLOUD.	
	Mean humidity.	Departure from normal.	Mean vapour tension in inches of mercury.	Departure from normal in inches of mercury.	Mean cloud amount at 8 hrs.	Departure from normal.
	%					
Burma . . .	83	— 2	·565	—·009	4·0	+1·0
Assam . . .	92	— 1	·437	+·008	3·4	+0·2
Bengal . .	84	0	·458	0	1·3	—0·3
Bihar and Orissa .	79	+ 2	·389	+·005	1·3	—0·1
United Provinces .	78	+ 1	·323	+·005	0·7	—0·7
Punjab . .	83	+11	·281	+·036	2·7	0
North-West Frontier Province.	83	+12	·244	+·031	4·3	+1·1
Sind . . .	63	+ 3	·280	—·007	0·6	—1·5
Rajputana . .	63	+ 5	·268	+·018	1·4	—0·6
Bombay . .	65	+ 5	·408	+·009	1·0	—0·5
Central India .	70	+ 6	·304	+·010	0·9	—0·7
Central Provinces .	63	0	·343	+·010	1·1	—1·0
Hyderabad . .	63	0	·437	+·009	1·4	—0·4
Mysore . .	68	— 6	·455	—·037	2·3	—1·5
Madras . .	78	+ 1	·626	—·014	3·5	—0·2

Rainfall.

13. The total fall of the month was in defect over the whole country with the exception of the Bay Islands, Lower Burma, Kashmir and the North-West Frontier Province; the deficiency was greatest (1½ inches) in south-east Madras.

TABLE 15.

SUB-DIVISION.	NUMBER OF RAINY DAYS.		RAINFALL.			
	Actual.	Normal.	Actual.	Normal.	Departure from normal.	Percentage departure from normal.
			"	"	"	
1. Bay Islands	13·5	4·5	7·92	4·59	+3·33	+ 73
2. Lower Burma	1·3	0·5	0·66	0·28	+0·38	+136
3. Upper Burma	0·1	0·8	0·04	0·38	—0·34	— 89
4. Assam	0·2	0·8	0·06	0·35	—0·29	— 83
5. Bengal	0	0·3	0	0·16	—0·16	—100
6. Orissa	0	0·7	0	0·37	—0·37	—100
7. Chota Nagpur	0·2	0·4	0·04	0·22	—0·18	— 82
8. Bihar	0	0·2	0·01	0·09	—0·08	— 89
9. United Provinces, East	0·6	0·5	0·19	0·26	—0·07	— 27
10. Do. do., West	0·5	0·9	0·25	0·42	—0·17	— 40
11. Punjab, East and North	1·2	0·9	0·44	0·49	—0·05	— 10
12. Punjab, South-west	0·5	0·5	0·16	0·22	—0·06	— 27
13. Kashmir	4·5	2·7	2·57	1·97	+0·60	+ 30
14. North-West Frontier Province	3·2	1·0	1·31	0·57	+0·74	+130
15. Baluchistan	1·4	1·9	0·53	0·78	—0·25	— 32

Sub-division.	Number of rainy days.		Rainfall.			
	Actual.	Normal.	Actual.	Normal.	Departure from normal.	Percentage departure from normal.
			"	"	"	
16. Sind	0	0·2	0	0·08	−0·08	− 100
17. Rajputana, West	0·1	0·3	0·03	0·16	−0·13	− 81
18. Do., East	0	0·7	0·01	0·28	−0·27	− 96
19. Gujarat	0	0·2	0	0·06	−0·06	− 100
20. Central India, West	0	0·6	0	0·27	−0·27	− 100
21. Do., East	0·2	0·6	0·10	0·28	−0·18	− 64
22. Berar	0	0·7	0	0·39	−0·39	− 100
23. Central Provinces, West	0·2	0·7	0·06	0·42	−0·36	− 86
24. Do., East	0·1	0·8	0·03	0·47	−0·44	− 94
25. Konkan	0	0·3	0	0·16	−0·16	− 100
26. Bombay Deccan	0	0·5	0	0·31	−0·31	− 100
27. Hyderabad, North	0	0·7	0	0·38	−0·38	− 100
28. Do., South	0	0·4	0	0·23	−0·23	− 100
29. Mysore	0·1	0·9	0·05	0·51	−0·46	− 90
30. Malabar	0·9	1·4	0·60	1·03	−0·43	− 42
31. Madras, Southeast	3·1	4·2	2·09	3·54	−1·45	− 41
32. Do., Deccan	0·2	0·9	0·10	0·49	−0·39	− 80
33. Do. Coast, North	0·9	1·2	0·51	1·01	−0·50	− 50

TABLE 16.

Division.	Rainfall.			
	Actual.	Normal.	Departure from normal.	Percentage departure from normal.
	"	"	"	
Burma	0·28	0·35	−0·07	− 20
Assam	0·06	0·35	−0·29	− 83
Bengal	0·00	0·16	−0·16	−100
Bihar and Orissa	0·02	0·19	−0·17	− 89
United Provinces	0·22	0·35	−0·13	− 37
Punjab	0·37	0·42	−0·05	− 12
North-West Frontier Province	1·31	0·57	+0·74	+130

Division.	Rainfall.			
	Actual.	Normal.	Departure from normal.	Percentage departure from normal.
	"	"	"	
Sind	0·00	0·08	−0·08	−100
Rajputana	0·02	0·25	−0·23	− 92
Bombay	0·00	0·20	−0·20	−100
Central India	0·05	0·27	−0·22	− 81
Central Provinces	0·03	0·43	−0·40	− 93
Hyderabad	0·00	0·31	−0·31	−100
Mysore	0·05	0·51	−0·46	− 90
Madras	1·25	2·20	−0·95	− 43
Mean of India	0·23	0·49	−0·26	− 53

Snowfall.

I.—AFGHANISTAN.

14. Snow fell to a depth of 3 feet in the vicinity of Paghman, of 1 foot in Lugman, and of 2½ feet on the Hindu Kush range.

II.—BALUCHISTAN.

There was a slight fall of snow on the first December on all the hills round Quetta; the snow had not wholly melted away by the 22nd of the month.

III.—NORTH-WEST FRONTIER PROVINCE.

(*a*) *Wano*:—There was no snowfall during the month.

(*b*) *Tochi (North Waziristan)*:—A light snowfall occurred on hills on the night of the 18th, the snow line descending to the level of the Vezhda range.

(*c*) *Kurram*:—A report written on the 18th shows that snow had fallen on 3 days on the high peaks of the Sufed Koh and on the 18th at Parachinar. The amount of snow lying on the 18th on Paiwar pass was 2″ and on Agam pass 5″. This is considered to be less than usual.

(*d*) *Drosh*:—Snow fell on the first and the second to a depth of about 8 feet on the Lawarai pass (10,000 feet) and of 2 to 3 feet on other high ranges. The accumulation at the end of the month on the Lawarai pass was 8 to 9 feet.

In the middle of the month snow was very thin on the southern aspect of higher ranges but there was a large amount on northern aspects.

IV.—KASHMIR.

(*a*) *Srinagar*:—Snow fell on 5 days during the month.

(*b*) *Skardu*:—Snow fell on the surrounding mountains on 11 days. Some of the falls were heavy, and amounted to 3 feet between the 22nd and the 24th and to 1 foot on the 27th. The accumulation at the end of the month was 4 or 5 feet on the higher ranges and 1 foot on the lower hills. The total fall of the month at the station itself was about 5 inches.

(*c*) *Dras*:—Snowfall occurred on 13 days during the month, the total amount being about 3½ feet.

(*d*) *Kargil*.—Snow fell on the surrounding mountains on 11 days, the accumulations at the end of the month being about 5 feet on Archulla mountain, 4 feet on Nakthulla and Samenulla, 2½ feet on Pazgolla and Narianulla, 2 feet on Barulla and all other neighbouring mountains, and about half a foot on the ground around the station.

(*e*) *Leh*.—The passes to the north were traversed with difficulty. Stretches of high ground were covered with snow during the last week of the month.

V.—PUNJAB.

(*a*) *Murree and the hills adjacent to Kahuta*.—43 inches of snow fell at Murree, the falls having occurred on 5 days between the 19th and the 30th.

No snow fell on the hills adjacent to Kahuta.

(*b*) *Kulu (Kangra)*.—Heavy and apparently widespread snowfall took place in Saraj, and almost certainly in Kulu also, on the 18th and the 19th; on the 20th snow was lying to about 6,000 feet, and below that level at sheltered places.

(*c*) *Kilba (Simla Hills)*.—Between the 1st and the 21st of the month there was a fall of 1 inch on one day (the 18th) down to 6,000 feet near Kilba and Nechar. The accumulations on passes on the 21st were as follows:—

TABLE 17.

Rupin pass	3 feet.
Brua „	4 „
Shatul „	5 „
Harang „	2½ „

All four of them were impassable.

VI.—UNITED PROVINCES.

(*a*) *Garhwal*.—Snow fell on peaks in the north of the district down to 8,000 feet.

(*b*) *Almora*.—The estimated snowfall during the first 17 days and the distance to which the snowline descended from the line of perpetual snows are given below:—

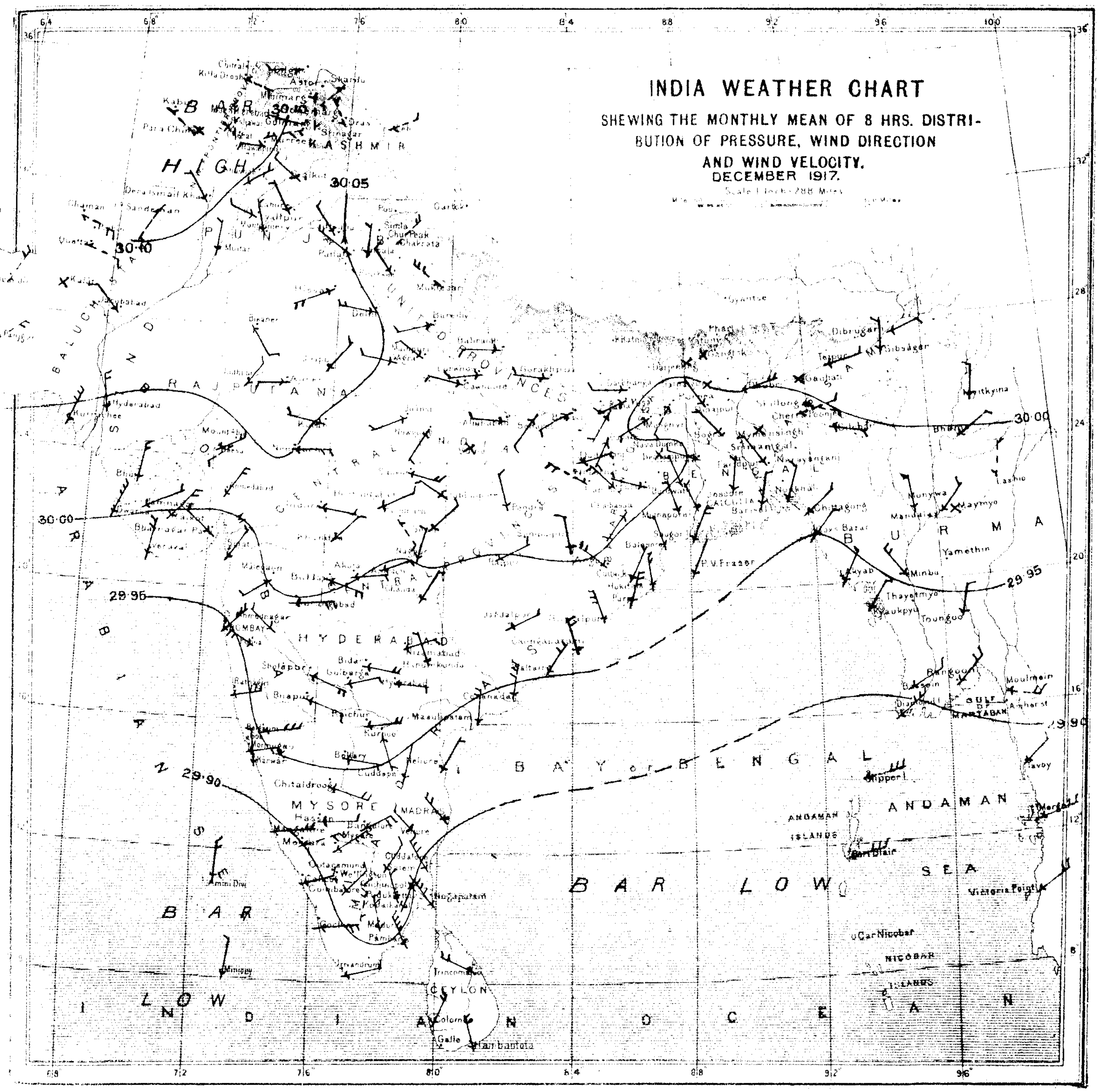
TABLE 18.

Name of pass or peak.	Snowfall.	Distance below perpetual snowline.
	Feet.	Miles.
Malla Darma	1½	1½
Malla Danpur	½	3 or 4
Malla Johar	3½	7½
Byans	2	12 or 13
Chaudas	1	½

SUMMARY.

14. The month's fall was roughly normal in Afghanistan and the hills of the United Provinces, in excess in the Punjab and Kashmir and in defect in the North-West Frontier Province and Baluchistan.

S. SITARAMAYYA.

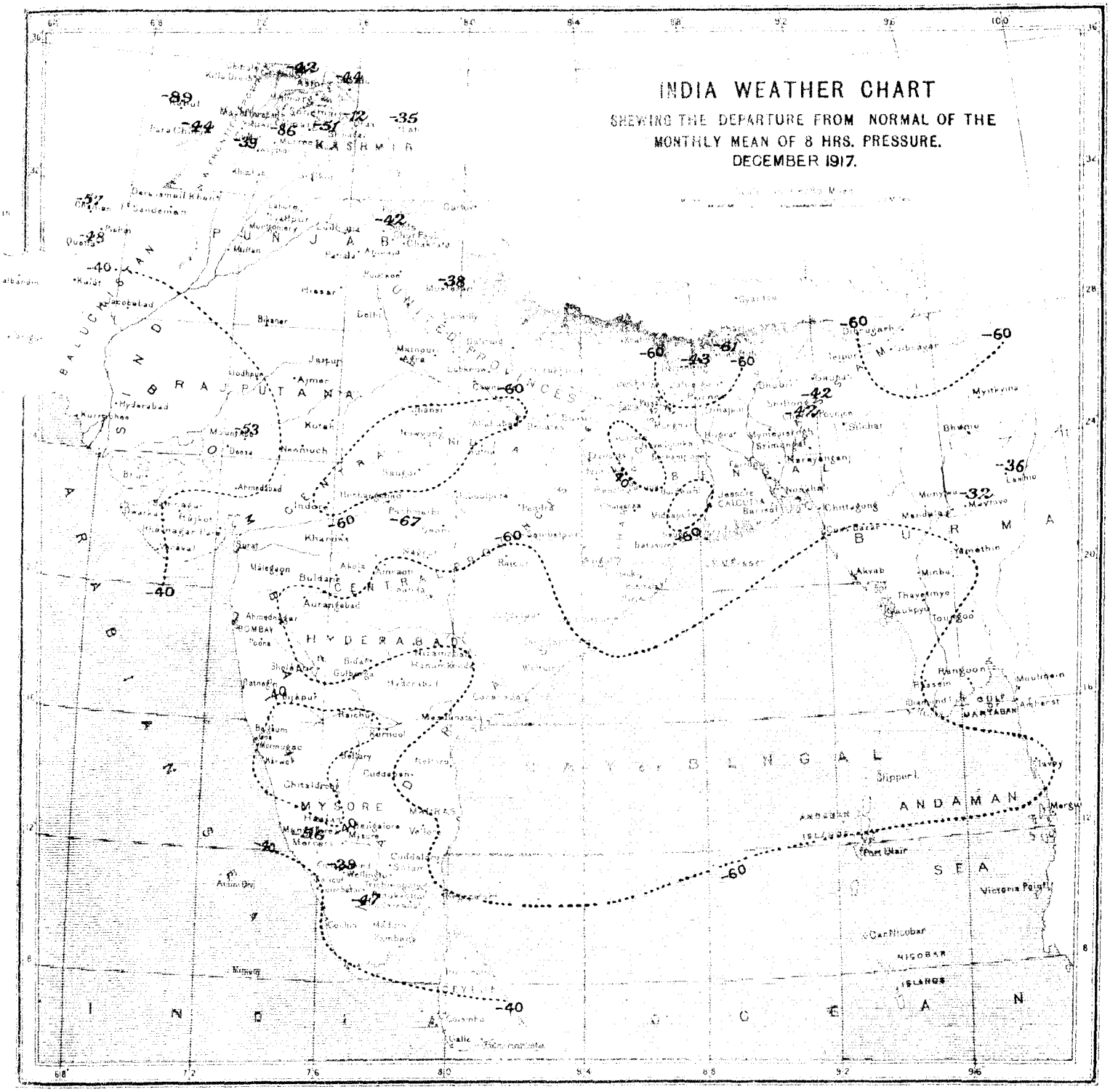


The lines of the above chart represent isobars or lines of equal barometric pressure, the numbers attached indicating the barometric pressure in inches and being drawn for differences of pressure of ·05 inch. The isobars in the Bay of Bengal are filled in by means of the shore observations, and by comparison with the normal distribution of pressure.

The mean 8 hrs. wind directions of the month are shewn by means of arrows flying with the wind, and are calculated by means of Lambert's formula applied to the winds as given in Table B of the 8 hrs. observations. The mean wind directions for the hill stations are indicated by broken arrows to distinguish them from the wind arrows for the plain stations. The mean velocity of the winds during the month is shewn by the following notation:—

Velocity of	0 to 2 miles per hour	...	one feather added to the wind arrow.
,, ,,	2 to 5 ,, ,, ,,	...	two feathers ,, ,, ,, ,,
,, ,,	5 to 10 ,, ,, ,,	...	three ,, ,, ,, ,, ,,
,, ,,	10 to 20 ,, ,, ,,	...	four ,, ,, ,, ,, ,,
	over 20 ,, ,, ,,	...	five ,, ,, ,, ,, ,,

Wind strengths are based on factor 2·2 for the standard type of Beckley Robinson anemograph, instead of 3·0 as used for this plate up to December 1911 inclusive.



The chart shows the departure from normal of the mean during the month of 8 hrs. pressure by means of lines drawn for equal amounts of departure. The numbers are given in thousandths of an inch, 20 representing '020' or two hundredths of an inch, &c. Continuous lines indicate that the pressure was in excess by amounts indicated by the numbers attached to the lines, and broken or dotted lines that it was in defect by amounts indicated by the numbers attached to the lines. Two parallel lines near to each other, one continuous and the other broken or dotted, represent the line of no departure, the dotted line facing the area of deficient pressure or negative departures.

CHART SHEWING THE DEPARTURE FROM NORMAL
OF THE MONTHLY MEAN OF DAILY
MAXIMUM TEMPERATURE.

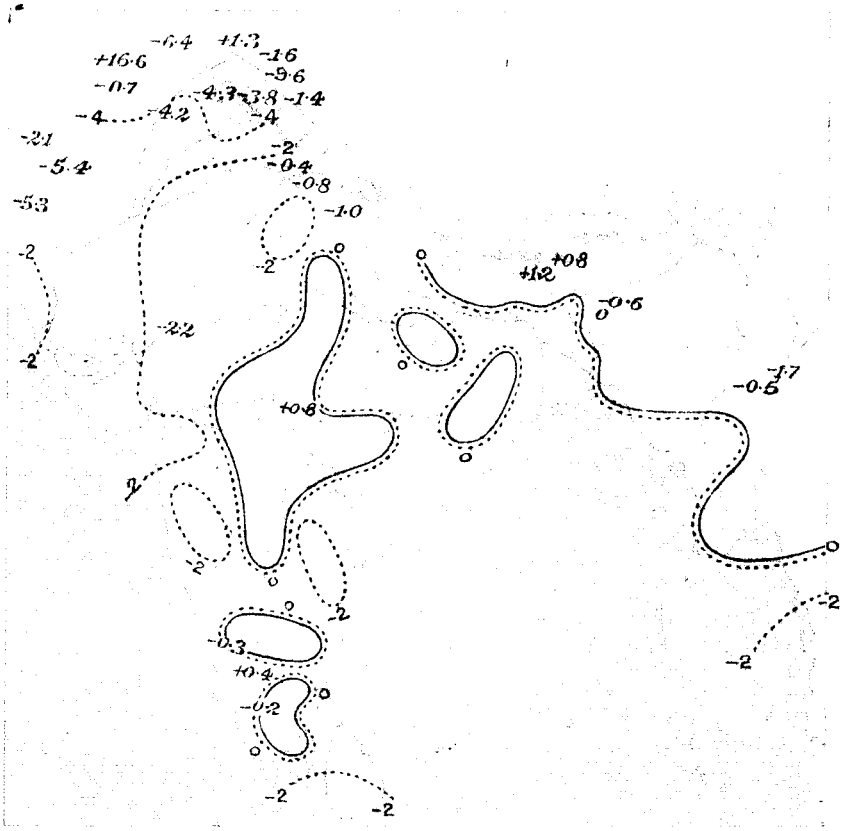


CHART SHEWING THE DEPARTURE FROM NORMAL
OF THE MONTHLY MEAN OF DAILY
MINIMUM TEMPERATURE.

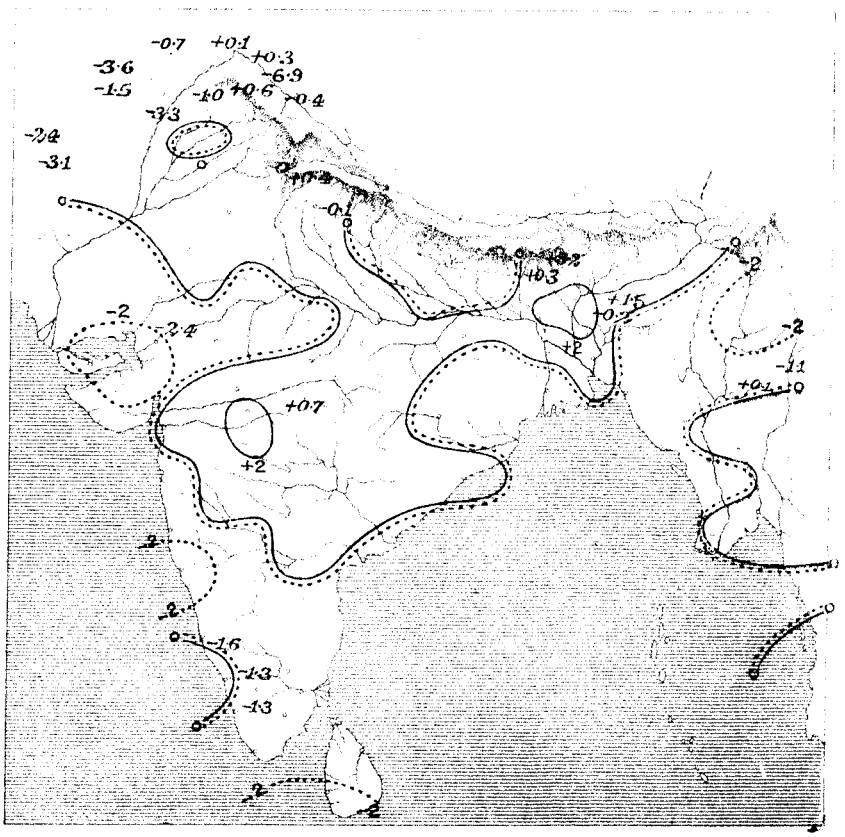


CHART SHEWING THE DEPARTURE FROM NORMAL
OF THE MONTHLY MEAN OF DAILY
MEAN TEMPERATURE.

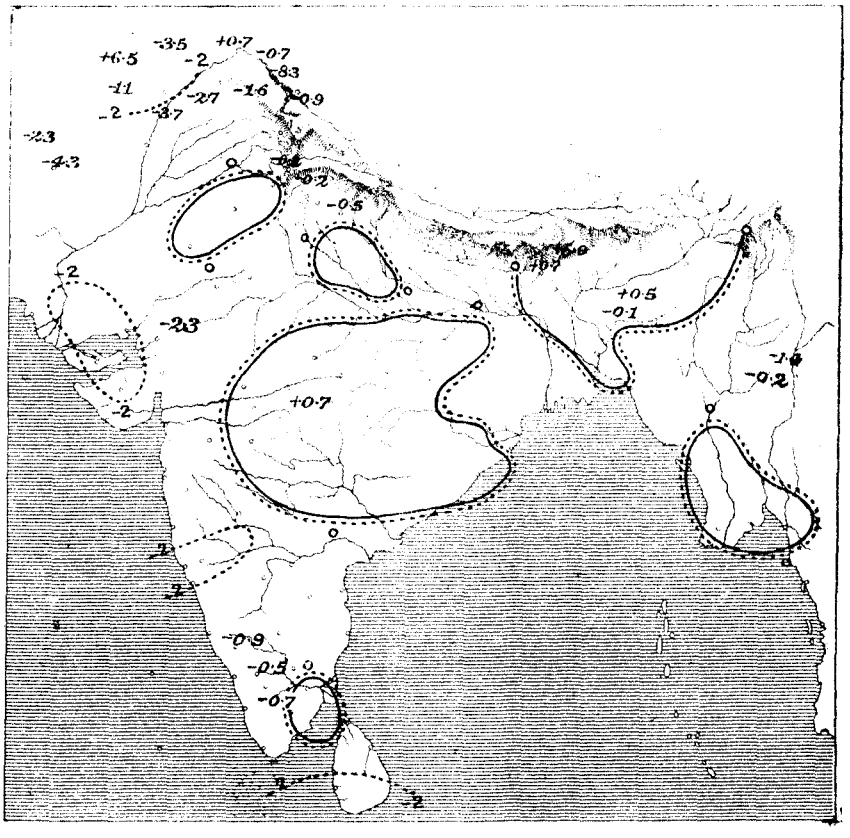


CHART SHEWING THE DEPARTURE FROM NORMAL
OF THE MONTHLY MEAN OF ABSOLUTE
HUMIDITY AT 8 HRS.

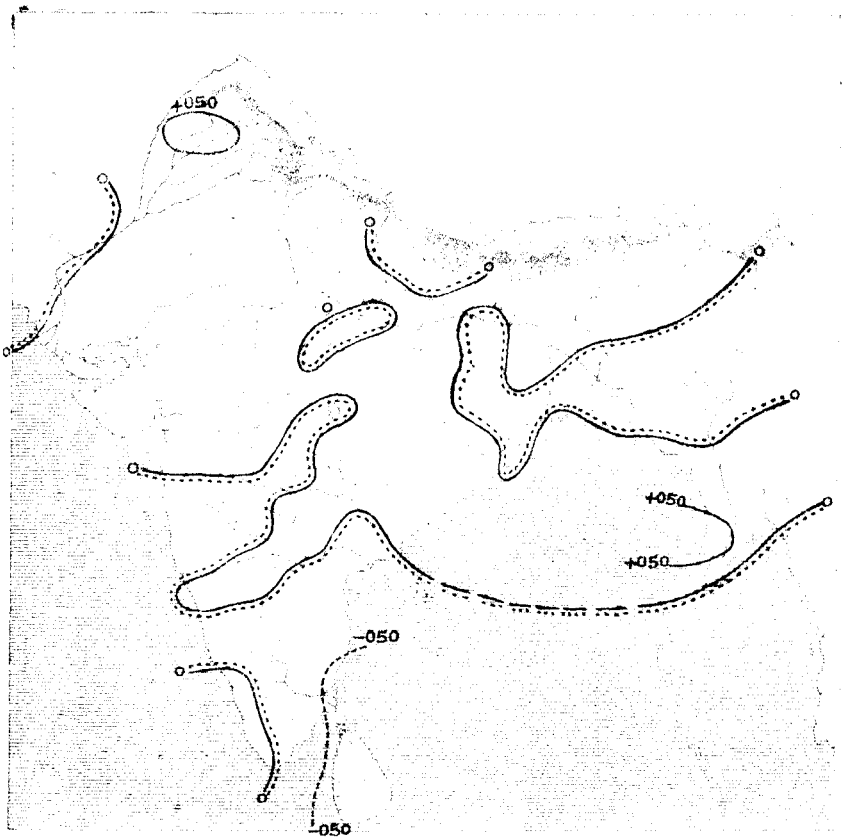


CHART SHEWING THE DEPARTURE FROM NORMAL
OF THE MONTHLY MEAN OF RELATIVE
HUMIDITY AT 8 HRS.

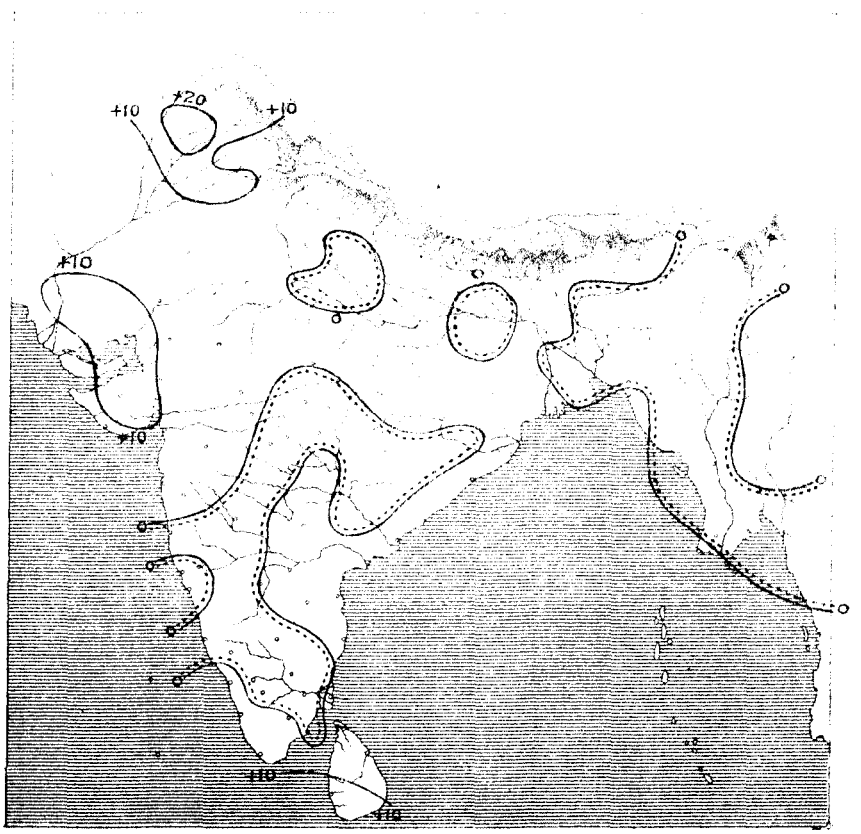


CHART SHEWING THE DEPARTURE FROM NORMAL
OF THE MONTHLY MEAN OF CLOUD
AMOUNT AT 8 HRS.

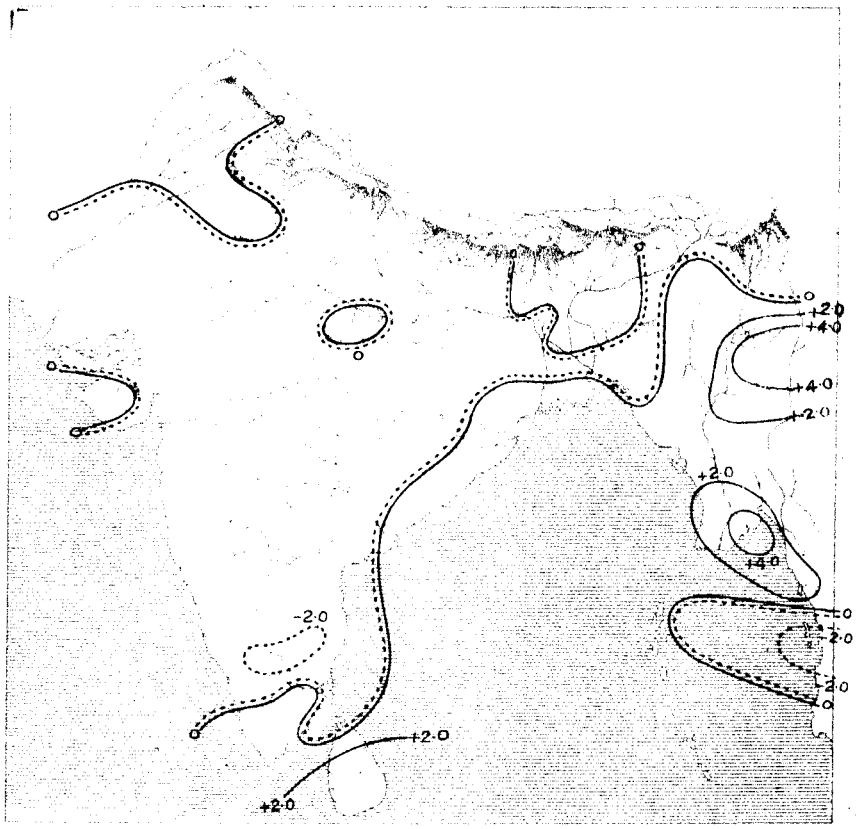
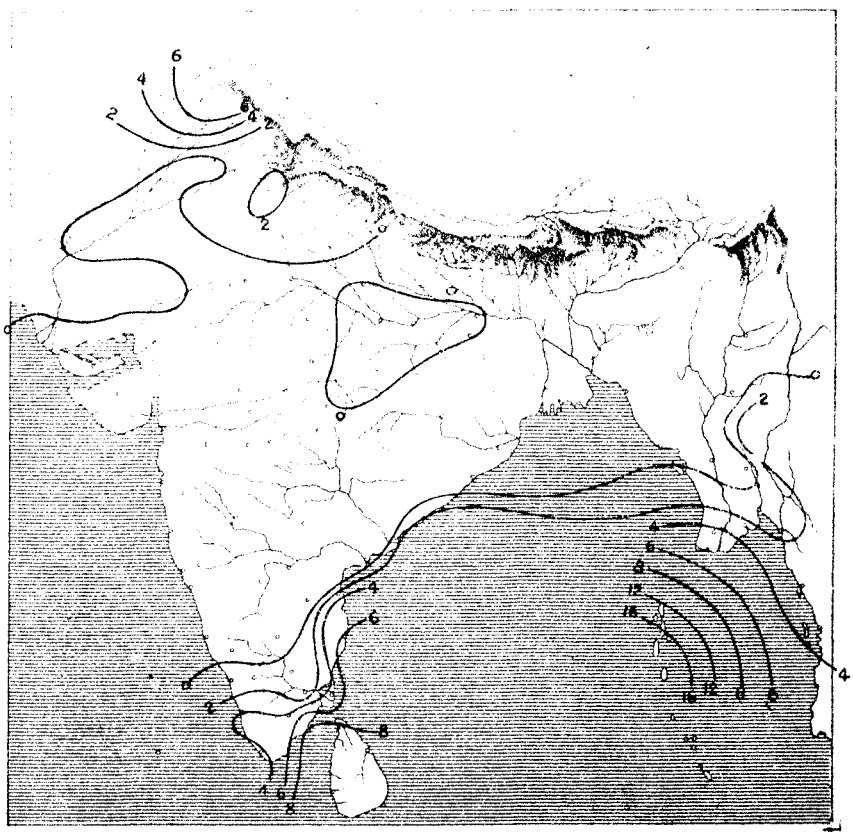
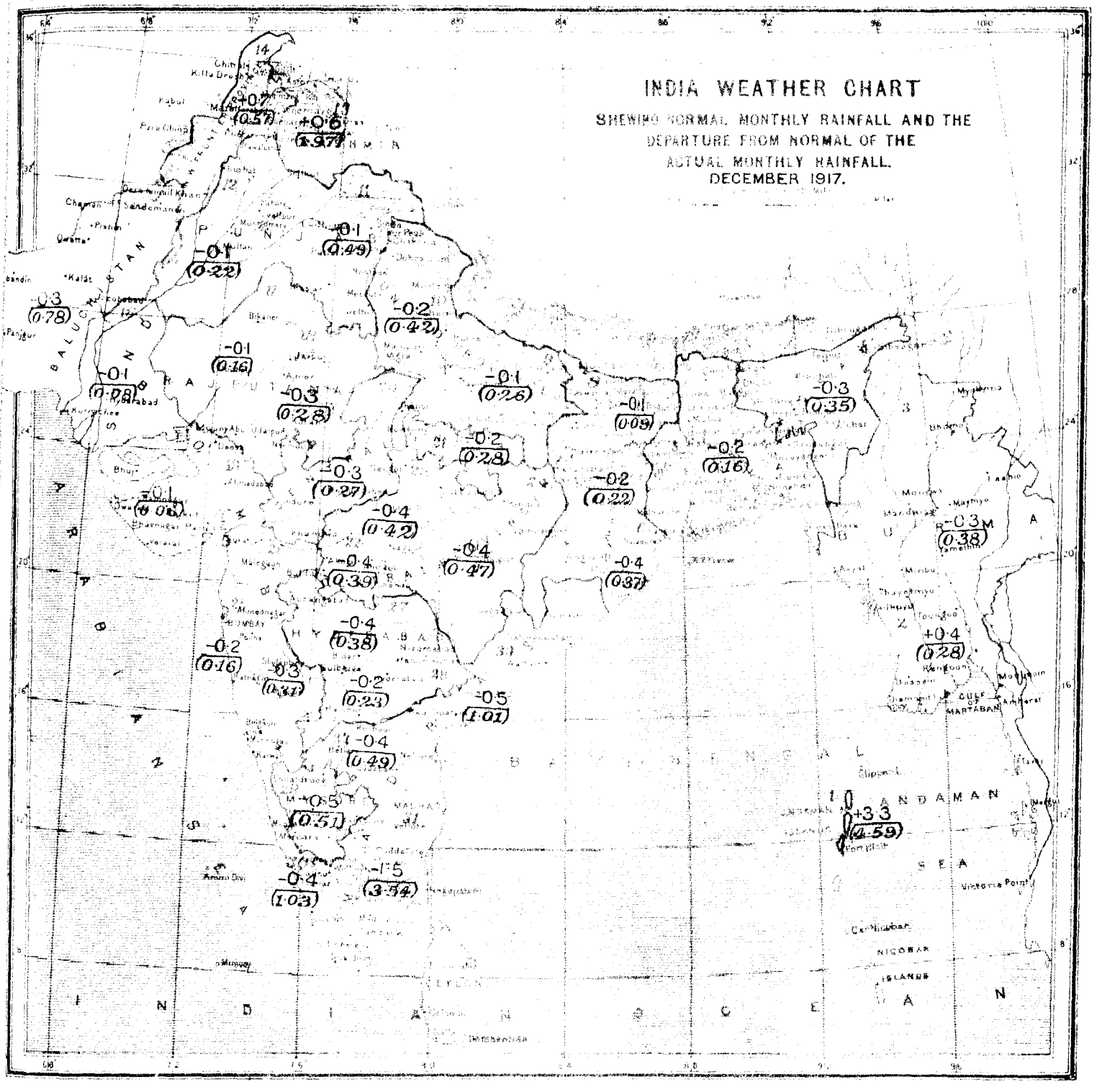


CHART SHEWING THE TOTAL NUMBER OF DAYS IN THE
MONTH ON WHICH RAINFALL EQUALLED OR
EXCEEDED 0·10 INCH.
(BASED ON THE RETURNS OF TABLE B.)





The country is divided into 33 areas as shewn in the list below. The numbers in that list correspond with the red numbers on the chart, and serve to identify the areas. The numbers in brackets on the chart give the average over the divisions of the normal monthly rainfall, the numbers above these give the departures from normal of the average actual rainfall over the divisions.

1. Bay Islands
2. Lower Burma
3. Upper Burma
4. Assam
5. Bengal
6. Orissa
7. Chota Nagpur
8. Bihar
9. United Provinces, East
10. United Provinces, West
11. Punjab, East and North
12. Do., Southwest
13. Kashmir
14. Northwest Frontier Province
15. Baluchistan
16. Sind
17. Rajputana, West
18. Rajputana, East
19. Gujarat
20. Central India, West
21. Do., East
22. Berar
23. Central Provinces, West
24. Do., East
25. Konkan
26. Bombay, Deccan
27. Hyderabad, North
28. Hyderabad, South
29. Mysore
30. Malabar
31. Madras, Southeast
32. Madras, Deccan
33. Madras Coast, North